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Marketing
Research Report
Number 1142

Computer Feasibility for Fresh Fruit and Vegetable Wholesalers

By Bruce E. Lederer

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Preface and Acknowledgments

This report is part of a continuing research program of the U.S. Department of Agriculture designed to find more efficient and less costly methods of marketing food products from producer to consumers. Certain technical information in this report was obtained under a contract agreement with Systemware Consultants, Toronto, Canada.

Grateful appreciation is extended to the wholesale fruit and vegetable companies, computer companies, software vendors, independent consultants, Government officials, university personnel, and many others throughout the country who cooperated in this study.

Appreciation is also extended to Joan M. Sullivan, Database Architecture Group, National Bureau of Standards, U.S. Department of Commerce, for her thorough and constructive review of this report.

Particular appreciation is extended to Charles H. Dickson, Manager, Microcomputer Technology Center, National Agricultural Library, U.S. Department of Agriculture, for his support and guidance during the early phases of this research, and for the excellent review performed by him and his staff of the first draft of this report.

April 1986

Computer Feasibility for Fresh Fruit and Vegetable Wholesalers

By Bruce E. Lederer[1]

Summary

The purpose of this study was to define the information requirements of fresh fruit and vegetable wholesalers, determine alternative systems to satisfy these requirements, and develop cost estimates for the selected alternatives. The companies described in this report were located in and around Philadelphia, New York, Boston, Chicago, Baltimore, and Los Angeles. The firms' gross sales ranged between $10 and $20 million.

The four major phases of this study were: (1) Present System Analysis, which profiles the selected sample of wholesalers and descibes their present manual office information procedures; (2) Requirements Analysis, which defines and analyzes the present information requirements; (3) Alternative Systems Analysis, which defines and analyzes possible alternatives to the present manual systems; and (4) the Cost/Benefit Analysis, which develops costs and benefits for each alternative.

With the current manual system, much of the essential data relating to purchase/costing, inventory control, and sales were processed using handwritten paper forms and often only small scraps of paper. Errors were frequent, and only a complex system of checks and balances at the end of the accounting day assured basically balanced books. Involvement of senior personnel in clerical matters was necessary and time consuming. Functional areas such as inventory were out of balance continually. And, although certain reports such as lot summaries, sales, and receiving journals were available, other important sales statistics were generally not prepared because of time delays, costs, and high probability of error.

The complex interaction of buying and selling commodities at a rapid pace, in addition to the generallly volatile nature of the business, requires a solution that will eventually automate most information flow procedures. A computer system which uses an integrated data base maintained in "real" time with concurrent access and update capability is the major requirement for the wholesalers described in this report. A truly integrated system captures data (such as sales ticket information) accurately at the source and relates it to all the systems components (such as inventory and receivables), thus providing a data background for all the activities of the company. To be most effective, a computer system for the fruit and vegetable wholesaler should satisfy the following general requirements:

- Central storage of all relevant data - a data base.
- Accessibility of all data by key personnel.
- The ability to enter data into the system the moment any transaction occurs, and to retrieve information instantaneously. This is particularly necessary for inventory levels and prices.
- Reduction of paper records to the bare minimum.
- Ability to track every transaction for audit purposes and for backup in case the system goes down.
- Control over the data entered to ensure its accuracy.
- Clear and accurate reports available in a timely fashion.
- Simple operation. Usage should be easy and natural.
- Adequate security to protect computer system from physical damage, loss of data, and unauthorized access.

The general objectives of a proposed computer system are twofold: (1) Less paperwork; less labor intensive functions; and faster, more accurate, and more productive processing of daily transactions; and (2) more accurate and sophisticated management information to the firm's executives.

There are two distinct computer alternatives to the present manual system: (1) A super microcomputer system, and (2) a mini data base computer system. Both systems have the capability of meeting wholesalers' basic requirements with the most advanced technology presently available, and have the ability to fit the operational pattern and resources of the wholesale firms for whom they are recommended. Both systems also integrate all the major functions of the

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business into a data base maintained in "real" time with concurrent access and update capability.

The super microcomputer system is recommended for the majority of wholesalers who have determined their need for a system, have gross sales under $15 to $20 million annually, desire a relatively simple system with the least possible disruption of their internal operational procedures, and don't expect sales to increase above $30 to $35 million in the next four or five years. The system could pay for itself within the first year after implementation and produce a five-year life cycle savings of over $850,000.

The mini data base computer system is recommended for upper end mid-level wholesalers (over $20 million annual sales) who expect substantial growth over the next four or five years, and for wholesalers whose sales presently exceed $30 to $35 million. The system could pay for itself within the first year after implementation and produce a five-year life cycle savings of about $1.21 million.

In summary, there is no simple formula which guarantees a successful computer implementation. A combination of variables must mesh together well for an optimum solution. Many of these variables are discussed in this report: (1) A clear undestanding of the wholesale company's requirements; (2) a concern for the welfare of the company's employees; (3) total support from senior company management; (4) a high quality computer system (software, hardware and operators); (5) a skilled, informed, and reliable vendor from whom the hardware and software were purchased; (6) a well plannned and timely system implementation; (7) good user documentation that provides clear instructions for operating the system; (8) adequate training for the users of the system; and (9) adequate and reliable single source support (service contract) to assure the continuity of the system with a minimum of disruption and downtime when repairs are necessary.

Introduction

Background

The speed with which computer technology has spread is well known. During the past decade, miniaturization has advanced rapidly, computer capacity has soared, and prices have plunged. Small, inexpensive, mini- and microcomputers are now commonplace in factories, stores, laboratories, offices, and engineering departments.

Alvin Toffler, author of **Future Shock** and **The Third Wave**, quotes Computerworld Magazine: "If the auto industry had done what the computer industry has done in the last 30 years, a Rolls-Royce would cost $2.50 and get 2,000,000 miles to the gallon." In short, the technological revolution is extending the limits of our minds as the industrial revolution did our muscles, but with the speed and to a degree which cannot yet be conceived.

The wholesale fresh fruit and vegetable industry is on the verge of a computer explosion. With few exceptions, however, wholesalers are having difficulty accessing and making sense of information that could provide them with an understanding of computer capabilities, short and long term alternatives to their present manual systems, and a concrete plan for gradually phasing computers into their operations. Without clear information, there is a great possibility that these companies will, in the next decade, spend large sums of money for computer systems which will not meet their needs.

Requirements for information are increasing because of pressures, both internal and external, to their companies. As in other industries, these wholesalers are gradually becoming inundated with a high volume of repetitive clerical tasks and are experiencing an increasing awareness of the need to have timely, accurate,and flexible analysis to aid them in making decisions at all levels of operations. As competition increases, it is necessary to maintain quick responsiveness to both suppliers and customers along the distribution channel (fig. 1). Government regulations (Perishable Agricultural Commodities Act) require that business transactions be kept current and appropriate records maintained for specified periods of time. To maintain an efficient operation and to prepare for a future where competition, volume, and government regulation necessitate more efficient data processing, data analysis, and data storage, many wholesalers are considering the use of computers.

Fresh fruit and vegetable wholesalers are often bright businessmen and have good "street savvy." Generally, however, they are technically unsophisticated. As a result many seem to have three basic responses to computers: (1) Avoid reality and continue business as usual, (2) take no action and "wait and see," or (3) begin incorporating computers even though planning is often incomplete and

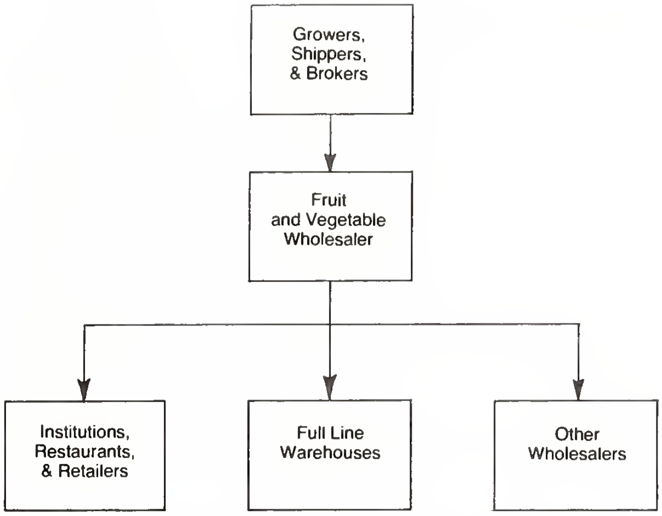

Figure 1.—Wholesale fruit and vegetable distribution system.

unclear. This last response is the route that some progressive firms are beginning to take, and it is with these firms that the major problems seem to be developing. Because of the relative lack of clear information available to them, they are beginning to purchase, on an individual basis, computer systems that often do not do the jobs for which they were obtained. Some wholesalers have purchased hardware that either lacked initial capacity to deal with present volume, did not have the capability of expanding as the firm's needs grew, or had not yet had application software developed to operate compatibly with it.

In other situations, software programs were developed by independent programmers and, after they were implemented, were found to be impossible to change or tailor to specific applications. In addition, appropriate training, documentation, and support for users have often been lacking.

According to discussions with various spokespersons for the fruit and vegetable industry, there is considerable interest within the industry in computer technology. However, concern is expressed over the apparent lack of reliable information available from an impartial source. From their own observations and personal experiences, they are concerned that a computer system for their individual companies may not do what was expected, and may not have the capability of evolving as the wholesalers' needs grow.

Although there has been considerable research published on the subject of computers, very little of this research has been tailored for produce industry needs. However, interest in the subject has generated articles in fruit and vegetable trade publications publicizing the various attributes of computers. Workshops and presentations have been given to different segments of the industry by hardware and software merchandisers, and by wholesalers who have incorporated computers into their operations. These meetings have been sponsored by groups such as the United Fresh Fruit and Vegetable Association, the Food Marketing Institute, the National-American Wholesale Grocer Association and the Produce Marketing Association.

Most of the information disseminated by these groups is on the basics of computers, including their operation and benefits, and general guidelines to follow when incorporating them. There are no publications, however, that specifically address the feasibility of incorporating computer systems into fruit and vegetable companies.

Purpose of Study

The purpose of this study was to describe the present operations of fruit and vegetable wholesalers, define their information requirements, determine alternative information systems to satisfy these requirements, and develop costs for the selected alternatives.

It is hoped that the results of this project will help fruit and vegetable wholesalers by providing them with the necessary information to bring them into the age of information automation with as much ease as possible, and help them gain or maintain a competitive edge in the food industry.

Procedures

A case study approach was used to develop a composite profile of a typical wholesale fruit and vegetable company. Descriptions, office procedures, and costs in the report are based on this composite.

Cooperating firms were selected on the basis of three criteria:

1. Their gross sales ranged between $10 and $20 million.
2. They carried a full line of fruits and vegetables.
3. They were willing to cooperate because of their interest in the project.

Excluded were firms specializing in a limited number of items or those firms that carried food lines in addition to fruits and vegetables.

The office operations of 20 firms were examined. Ten of these firms had manual operations and the remaining 10 were computerized. The firms with manual operations were used to develop the composite model in this report. Information from the 10 computerized firms was used to develop the background information for this study and to gain a better understanding of a cross section of the industry, including the right way and wrong way to computerize a produce company.

The firms studied were located in and around Philadelphia, Baltimore, New York, Chicago, Boston, and Los Angeles.

Although most companies studied were in wholesale produce markets, the information in this report is equally applicable to wholesalers outside of produce centers because of the similarity of their requirements.

This report is intended to provide general guidelines for computerization of wholesale produce companies and is not intended to recommend or endorse specific hardware or software products. Wholesalers are strongly urged to obtain reliable consulting services concerning their specific requirements.

Present System Analysis

Profile Statistics

The typical wholesale firm studied grossed $14.5 million in sales annually. Slightly more than half of those sales were titled to the wholesaler (52.5 percent), and slightly less than half (47.5 percent) were on consignment.

An average of 142 different fresh fruit and vegetable items were handled per year with nearly 1,000 variations distinguished by size, color, and other characteristics.

The firms' personnel averaged 30 people: 13 administrative and 17 warehouse laborers. Of the administrative personnel, there were two owners, five sales personnel, five bookkeepers/clerks, and one office manager.

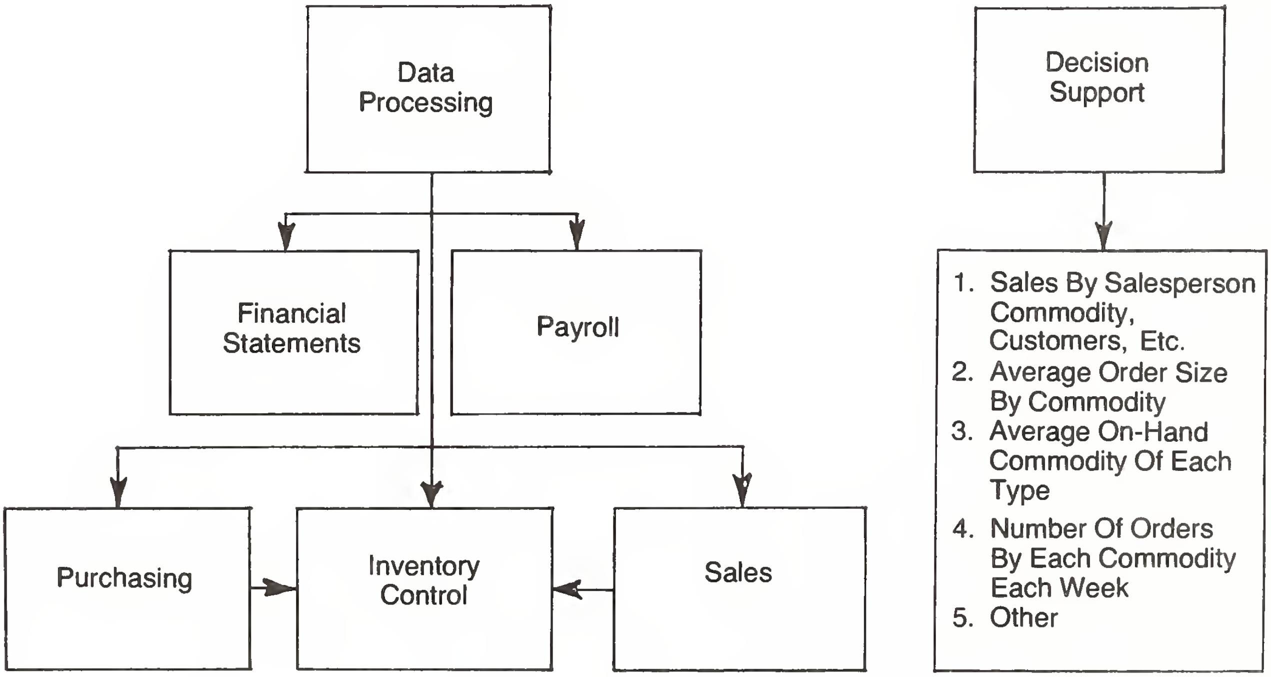
Data Processing
Financial Statements
Payroll
Purchasing
Inventory Control
Sales
Decision Support
1. Sales By Salesperson Commodity, Customers, Etc.
2. Average Order Size By Commodity
3. Average On-Hand Commodity Of Each Type
4. Number Of Orders By Each Commodity Each Week
5. Other

Figure 2.—Information needs of fruit and vegetable wholesalers.

The following information summarizes statistics provided by the sample:

	Average	*Maximum*
Number of suppliers serving the business	170	230
Shipments received weekly	70	145
Items per shipment	5	14
Active lots in warehouse	65	105
Accounts payable update weekly	105	185
Checks written weekly	145	195
Customers	265	305
Sales slips processed daily	185	325
Line items per sales slip	5	20
Bills prepared weekly	215	265
Checks received weekly	215	265

The following reflects the primary outputs for different clerical functions and their frequency of occurrence:

Output	Frequency		
	Daily	Weekly	Monthly
Sales journal	X		
Lot summary	X		
Inventory summary	X		
Physical inventory	X		
Billing and accounts receivable		X	
Accounts payable checks	X		
Payroll checks		X	
Financial statements			X

Office Information Procedures

For purposes of this report there are two major categories of information needed for the wholesale fruit and vegetable business: (1) data processing, and (2) decision support. As shown in figure 2, data processing consists of the basic business processing functions of financial statements, payroll, purchase, inventory control, and sales. These are labor intensive activities and are presently taking most of the time of administrative personnel.

In contrast to data processing, decision support is an analysis function for which need has not been satisfied in a manual operation. The same data used for data processing can also be used for short-term and long-term planning (decision support). For example, as a function of updating inventory, a program could be designed to keep track of such statistics as sales by salesperson, commodity, and customer; average order size by commodity; average on-hand commodities of every type; number of orders for each commodity each week; and so on. These data could be summarized at the end of each week, or as required, to inform wholesalers of items most in demand in which markets, the best level of inventory for each item, those items that should be advertised,and so forth.

The same data can be reorganized and reformatted to assist in long-term planning. Wholesalers could receive reports from programs that analyze trends in product movement. These reports could project when (1 year, 2 years, 5 years) the present increase in sales would require expanded warehouse space or additional personnel.

Most decision support has traditionally been performed intuitively by wholesalers. They have not been aided by the sophisticated tools necessary to achieve this management information process most effectively and efficiently. Because the typical wholesaler presently has few or no decision support procedures, the analysis function will not be discussed any further in this section.

The following covers the present data processing procedures, with an emphasis on purchase, inventory control, and sales. In this description, inventory control will be included under "purchase" and "sales." Figure 3 gives a general summary of the functional flow and interrelationship of purchase, inventory control, and sales. Figures of greater detail for the individual processes will follow.

Purchase (fig. 4)—
- Merchandise is ordered by phone from shipper.
- Purchase order is written on a slip of scrap paper and awaits confirmation from shipper. After confirmation, the sales manager is notified by the buyer of what merchandise is due in.
- A manifest file for all relevent paperwork involved with that purchase order is started, and the purchase order slip is attached.
- The purchase order information plus inventory summary sheet of stock on hand go to sales floor for the night receiver.
- Upon physical receipt of merchandise, the manifest is checked against load contents and confirmed with original order.
- The wholesaler's manifest copy goes to the sales floor office, and the salesman or receiving clerk enters the merchandise description and amount in the receiving journal (to be posted daily to inventory summary) and assigns the lot number(s).
- An inventory board for each commodity is set up and includes the starting inventory (from summary sheet) plus additions for each commodity received.
- Manifest copy then goes to office and is posted to a "purchase" or a "consignment" journal, and includes the lot number, shipper, and purchase content.
- "Purchase" or "consignment" worksheets for each lot are begun and kept in a looseleaf ledger book until lot is sold.
- The manifest then goes to the manifest file.

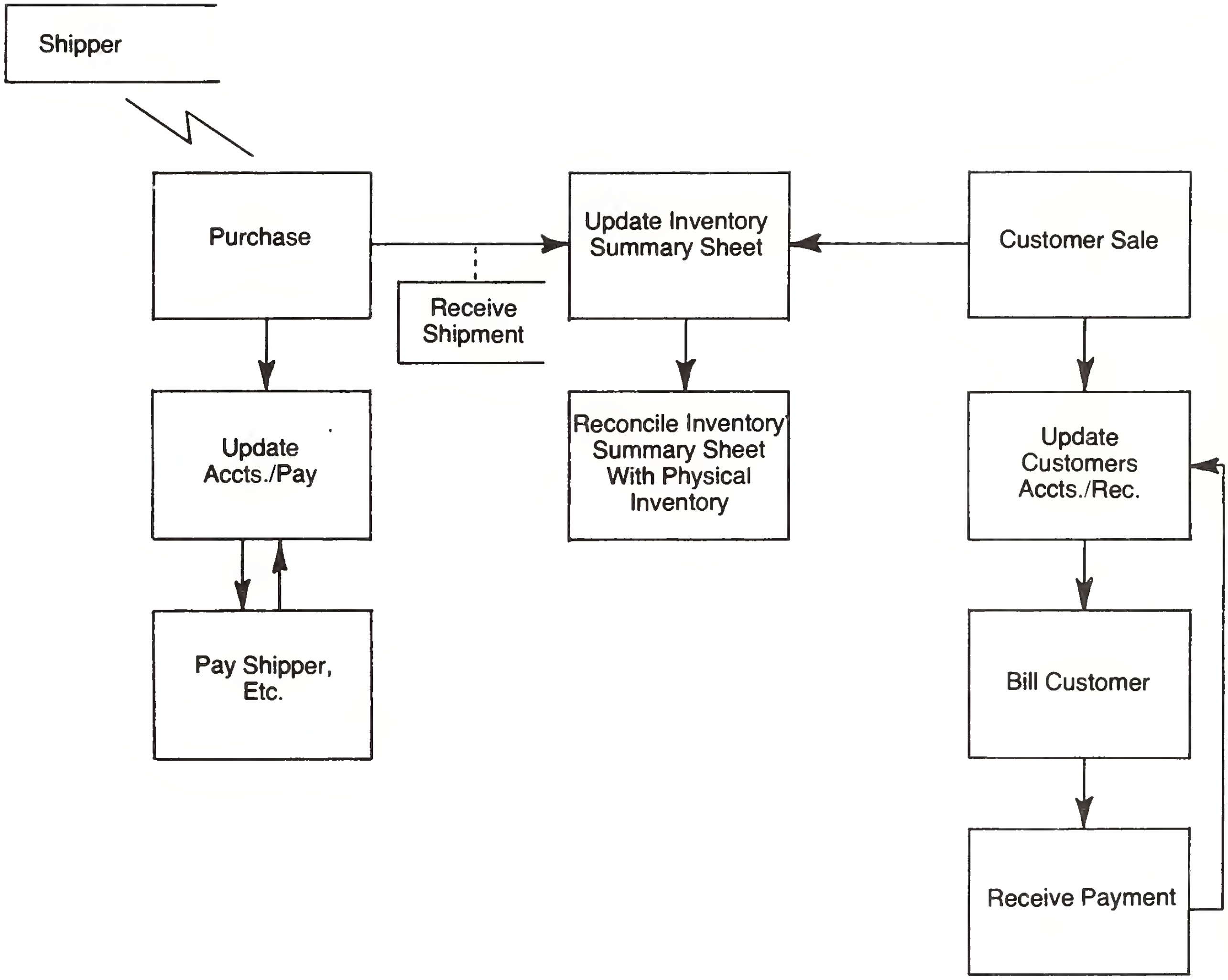
Shipper
Purchase
Receive Shipment
Update Inventory Summary Sheet
Customer Sale
Update Accts./Pay
Reconcile Inventory Summary Sheet With Physical Inventory
Update Customers Accts./Rec.
Pay Shipper, Etc.
Bill Customer
Receive Payment

Figure 3.—Purchase, inventory control, and sales:
A summary of internal functional flow of fruit and vegetable.

- Upon receipt of shipper's bill for purchased lots, wholesaler writes check and mails with copy of bill to shipper. Disbursement record is updated and copy of bill goes to manifest file.
- On the "consignment" worksheet, a running count is kept of sales from that lot. After the lot is sold, payment due to shipper is ascertained and disbursed, and profit or loss determined.
- On "purchase" worksheet, sales are also tracked, and profit or loss is determined after each lot is sold.
- When the purchase/consignment worksheets are closed, they go into their respective manifest files and await other related papers; for example, freight bill, unloading charge, delivery, and any other charge related to that lot.
- When freight and other bills arrive, the same process is repeated.
- After all bills are paid, this composite manifest file is stapled and filed in a "completed" file.

Sales (fig. 5)—

- When customer phones in order or buys on premises, salesman fills out three-part sales ticket.
- Copy 1 of sales ticket goes to main office; copy 2 goes to customer; copy 3 goes to warehouse for picker, signed by customer after order is received and any adjustments made, returned to main office, and reconciled with copy 1 if necessary.
- Salesman adjusts inventory "board(s)" at time customer's sales slip is written.
- Copy 1 of sales ticket goes to inventory clerk. It is extended, totaled, and recorded on inventory sheets (sales journal). (Cash sales are handled the same as credit sales except cash customers have no credit updates performed.) At end of day, inventory sheets are posted to inventory summary and reconciled with physical inventory.
- Billing clerk adds sales tickets on billing machine which automatically updates customer's individual bill and makes two copies. At end of week, bill is totaled, one copy is sent to customer and the other to "accounts receivable" file. Upon receipt of customer's payment, his accounts receivable is credited.

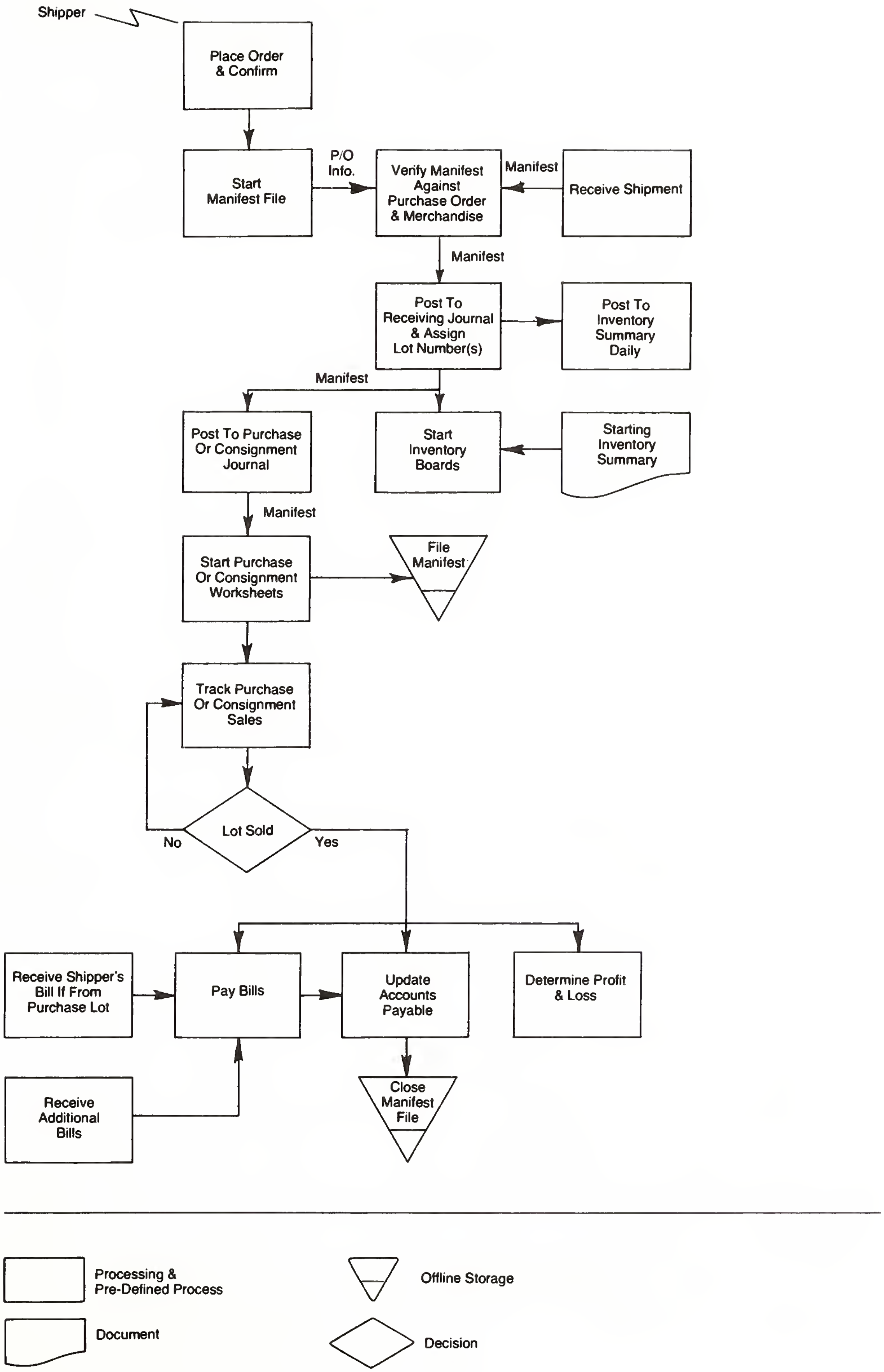
Shipper
Place Order & Confirm
Start Manifest File
P/O Info.
Verify Manifest Against Purchase Order & Merchandise
Manifest
Receive Shipment
Manifest
Post To Receiving Journal & Assign Lot Number(s)
Post To Inventory Summary Daily
Manifest
Post To Purchase Or Consignment Journal
Start Inventory Boards
Starting Inventory Summary
Manifest
Start Purchase Or Consignment Worksheets
File Manifest
Track Purchase Or Consignment Sales
Lot Sold
No
Yes
Receive Shipper's Bill If From Purchase Lot
Pay Bills
Update Accounts Payable
Determine Profit & Loss
Receive Additional Bills
Close Manifest File
Processing & Pre-Defined Process
Offline Storage
Document
Decision

Figure 4.—Purchase procedure.

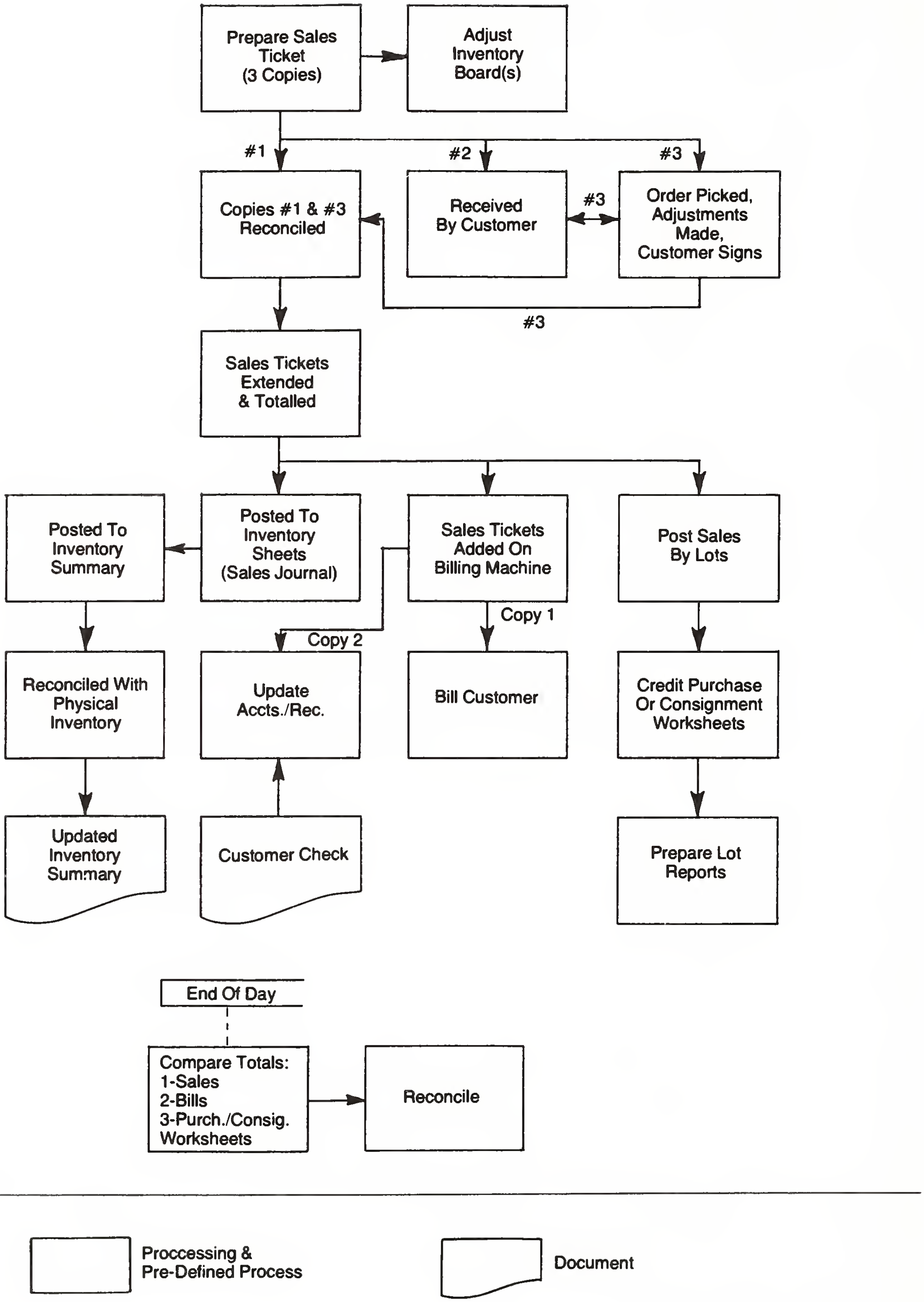
Prepare Sales Ticket (3 Copies)
Adjust Inventory Board(s)
#1
#2
#3
Copies #1 & #3 Reconciled
Received By Customer
#3
Order Picked, Adjustments Made, Customer Signs
#3
Sales Tickets Extended & Totalled
Posted To Inventory Summary
Posted To Inventory Sheets (Sales Journal)
Sales Tickets Added On Billing Machine
Post Sales By Lots
Copy 1
Copy 2
Reconciled With Physical Inventory
Update Accts./Rec.
Bill Customer
Credit Purchase Or Consignment Worksheets
Updated Inventory Summary
Customer Check
Prepare Lot Reports
End Of Day
Compare Totals:
1-Sales
2-Bills
3-Purch./Consig.
Worksheets
Reconcile
Proccessing & Pre-Defined Process
Document

Figure 5.—Sales procedure.

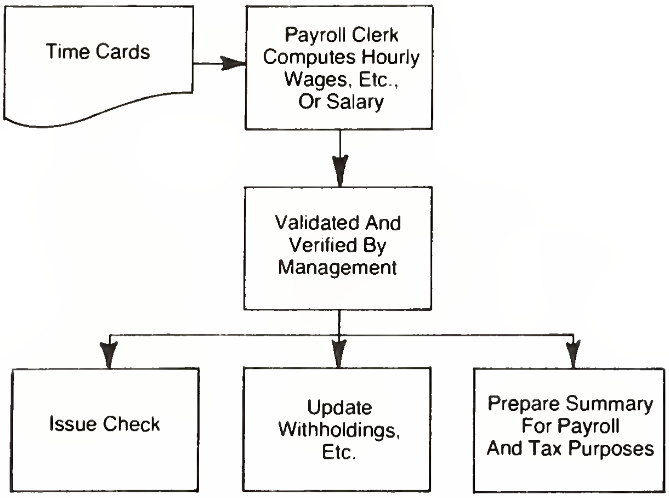
Time Cards
Payroll Clerk Computes Hourly Wages, Etc., Or Salary
Validated And Verified By Management
Issue Check
Update Withholdings, Etc.
Prepare Summary For Payroll And Tax Purposes

Figure 6.—Weekly payroll procedure.

- Sales tickets are posted during the day to individual pieces of paper by lot number. At end of day, each stack of papers for each lot is tallied and credited to "purchase" or "consignment" worksheets, and lot reports are prepared.
- Cross check of accuracy is done at end of each day by comparing total daily sales with total customer bills and total "consignment" or "purchase" worksheets.

Payroll (fig. 6)—
- Payroll clerk computes hourly wage or salary.
- Figures are validated and verified by management.
- File for withholdings such as health benefits, payroll savings, social security, and so on is updated.
- Summary for payroll and tax purposes is prepared.
- Check is issued to employee.

Financial Statements (fig. 7)—
- Ledgers and journals are sent to accountant and confirmed for accuracy.
- The subsidiary and general ledgers are updated.
- A trial balance is prepared and edited to ensure accuracy.
- Month end closing transactions are entered into the journal.
- Balance sheet and profit and loss statements are prepared.

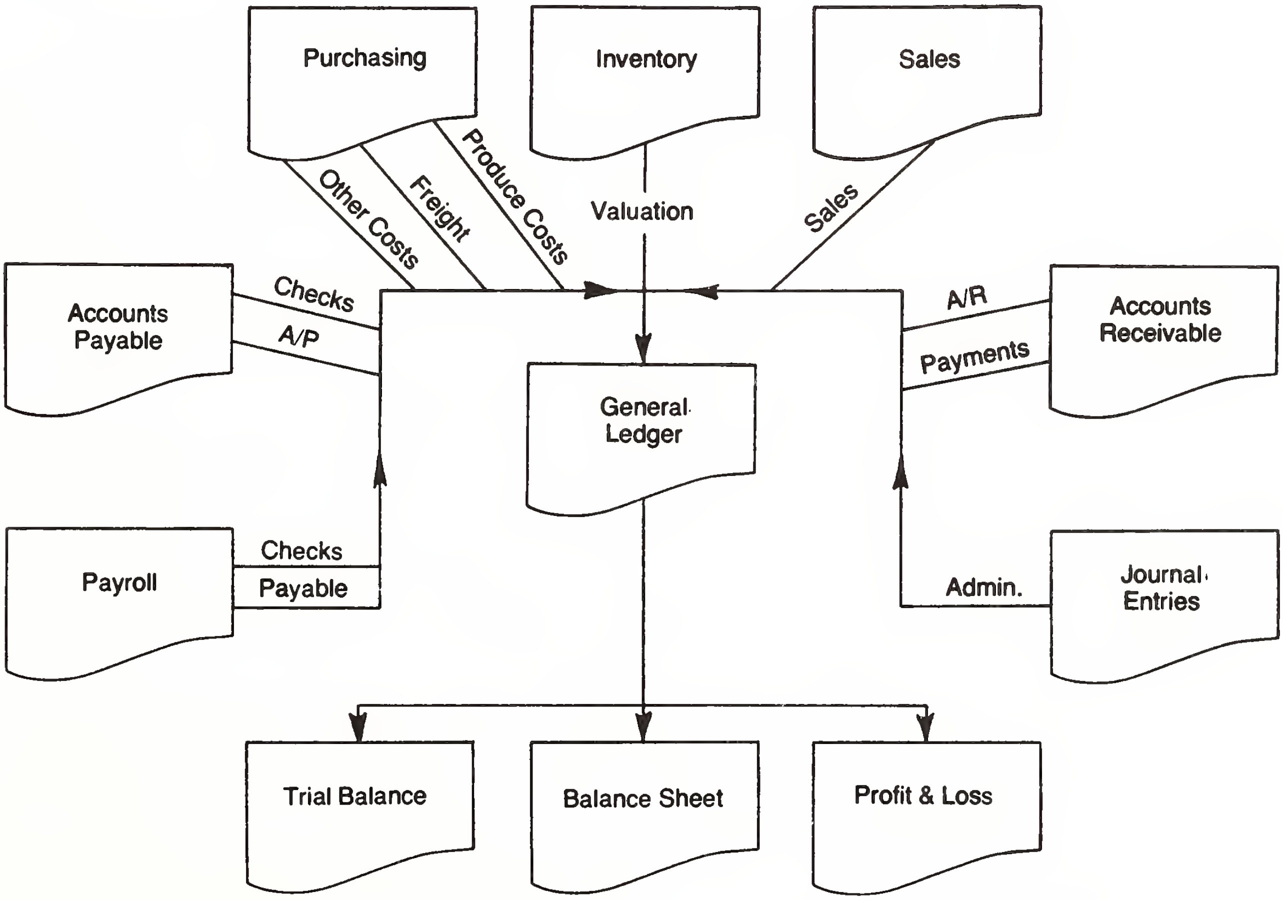

Figure 7.—Monthly financial statements.

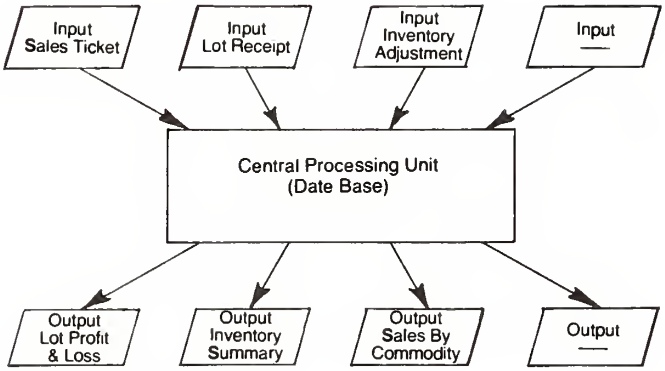

Figure 8.—Data processing.

The wholesale fruit and vegetable industry has proven to be one of the most difficult to automate. Piecemeal automation has occurred at various wholesale companies with limited success or substantial failure. This study has shown that the complex interaction of buying and selling commodities at a rapid pace, in addition to the generally volatile nature of the business, requires a solution that will eventually automate most information flow procedures of the business.

Figure 8 illustrates how data processing works in general. The inputs (sales tickets, lot receipts, and so on) are entered into the data base through an input device such as a keyboard terminal similar to the standard typewriter. The data from these inputs are processed through the central processing unit (CPU). CPU's are "sized" by the amount of working memory provided. This is expressed as thousands of bytes (kb), and for most wholesaler applications, 512,000 (512Kb) or more are needed. Beyond this, the size of the working memory is about as significant as horsepower ratings among automobiles. After processing, the outputs are extracted from an output device such as a terminal screen (similar to a television screen) or a printer.

A computer system which uses an integrated data base[2] *maintained in "real time"*[3] *with concurrent access and update capability is the major requirement for the wholesalers described in this report.* A truly integrated system captures data accurately at the source and relates it to all the system components, thus providing a data background for all the activities of the company.

These data can be used in two areas: (1) data processing and (2) decision support (fig. 2). For wholesalers who are contemplating computerization, a complete decision support system may not be implemented nor desired initially, but it will still be critical to the decision making process, which largely determines profitability. The first priority, however, is to relieve the burden of paperwork and provide more timely, accurate, and productive processing of current transactions.

To be most effective, a computer system for the fruit and vegetable wholesaler should fulfill the following general requirements:

1. Central storage of all relevant data - a data base.
2. Accessibility of all data by key personnel.
3. The ability to enter data into the system the moment any transaction occurs, and to retrieve information instantaneously. This is particulary necessary for inventory levels and prices.
4. The ability to reduce paper records to a minimum.
5. The ability to track every transaction for audit purposes.
6. Control over the data entered to ensure their accuracy.
7. Clear and accurate reports available in a timely fashion.
8. Simple operation. Usage should be easy and natural. Nonusers should be able to learn how to operate the system with minimum training.
9. Adequate security to protect computer system from physical damage, loss of data, and unauthorized access.

Although all of these requirements may not be met initially, wholesalers should be sufficiently aware of them to plan accordingly.

Outputs and Inputs

This section will review the basic outputs and inputs required for the major functions of the system. These functions are:

- Purchase and costing (includes accounts payable)
- Inventory control
- Sales (includes accounts receivable)
- General ledger and financial reporting
- Payroll

Identified for each output is its use, the frequency with which it should be generated, the areas of the business it may affect or be affected by (interfaces), and the distribution.

Identified for each input is the preparer of the document (source), the major sorting sequence or data elements organization, and the frequency of submission.

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[2] Data base refers to an integrated collection of files used to support the computer system. It can be thought of as the complete collection of papers stored in a company's filing cabinets. However, because files are stored in the computer, the data can be interrelated in a way that greatly increases the value of the information on file. For example, the correlation between the item in a given lot and all the sales tickets that reflect that item can be retrieved fairly quickly resulting in the reports needed to reconcile the daily transactions.

[3] "Real time" computer processing refers to a transaction that is processed within the computer at the time of its submittal. For example, when a sale is entered into the computer terminal, it is immediately processed and becomes an update of inventory.

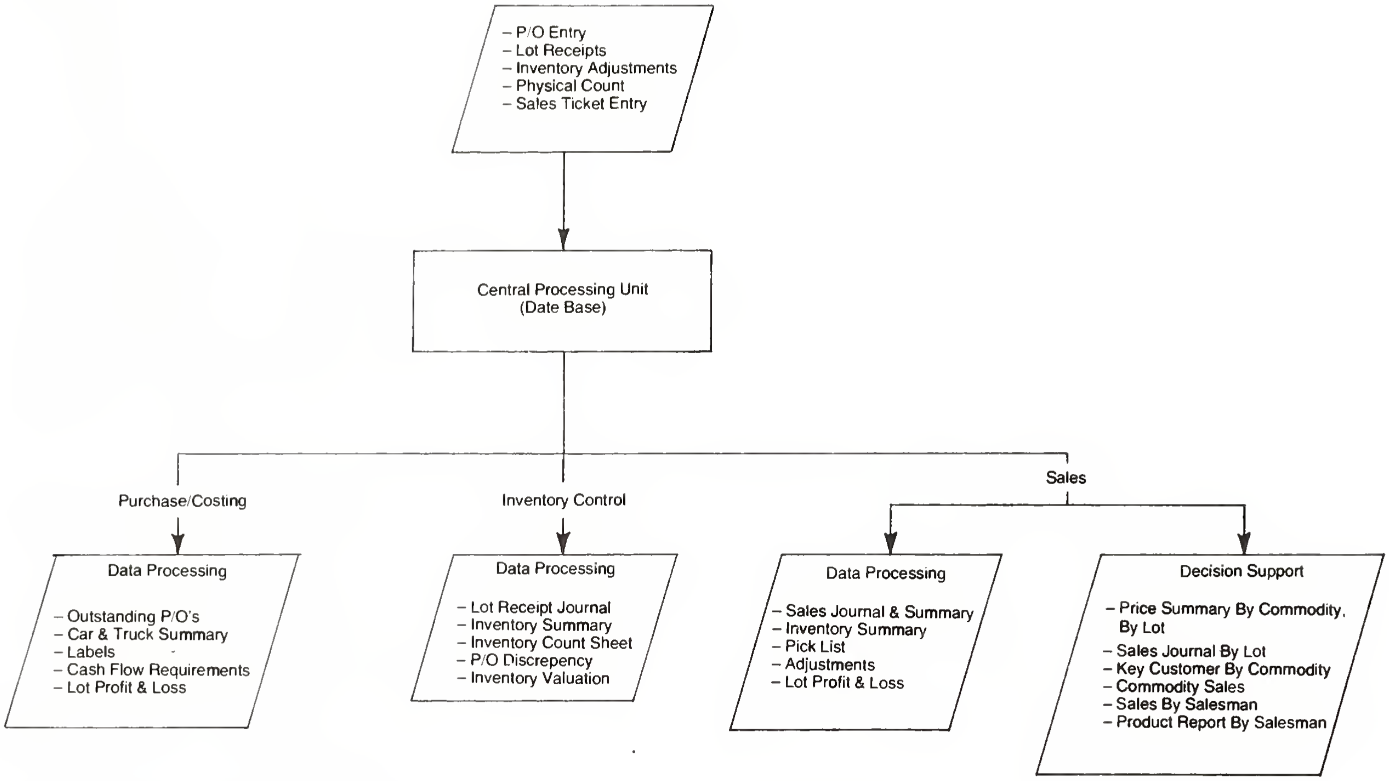

Figure 9.—Basic required inputs and outputs for the three major functions of the wholesaler: (1) Purchase/costing; (2) inventory control; and (3) sales.

The emphasis in this section is placed on purchase/costing, inventory control, and sales.

Careful consideration should be given to building flexibility into the reporting process. The reports (outputs) described are intended to be flexible. Various methods should be available to manipulate the programs that generate these reports to produce the same formatted report by different time periods, by different selected groups of customers, commodities, and so on.

Figure 9 summarizes the basic required inputs and outputs for the three major functions of the wholesaler: (1) Purchase/costing, (2) inventory control, and (3) sales.[4] This figure may be used as a graphic overview of the following discussion.

Purchase and Costing—Accurate cost information by lot is the primary input requirement necessary for understanding the true costs of goods received and for maintaining accurate profit and loss reports.

Reports that can track the goods before they arrive at the dock are also required. Once the goods arrive, it is important to review the manifest with the purchase order information to ensure that the goods delivered are the same as the goods ordered. Then each lot must be tracked in the warehouse by printing labels with the lot number on them.

The lot profit and loss report is a review of all the costs and sales for a given lot to determine net profits, and the cash flow requirements report shows cash requirements for outstanding purchase orders.

Outputs:

a. Outstanding Purchase Order Report - Organized by commodity, this details each outstanding purchase order and highlights quantity ordered, shipping date, due date, shipper routing, and total costs.
   - Use: to track all outstanding purchase orders
   - Frequency: on request
   - Interfaces: buyers
   - Distribution: buying office, sales personnel, receiving clerk

b. Car and Truck Summary - Organized by shipping date, this details all the merchandise enroute by shipper, truck license number, expected arrival date, and other relevant information.
   - Use: to expedite and track arriving merchandise
   - Frequency: daily
   - Interfaces: buyers
   - Distribution: buying office

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[4] Accounts payable, accounts receivable, general ledger, and payroll are not shown here because they have no particular requirements except as mentioned in the text.

c. Labels - These are self-adhering labels imprinted with lot numbers in bold characters.
  - Use: to attach to incoming merchandise to identify by lot
  - Frequency: as required
  - Interfaces: receiving
  - Distribution: receiving

d. Cash Flow Requirements - The output screen shows the cash requirements by purchase orders number over a weekly period based on outstanding purchase orders. The amounts should be totaled at the bottom of the screen.
  - Use: to determine cash requirements for a given period
  - Frequency: on request
  - Interfaces: controller
  - Distribution: controller

e. Lot Profit and Loss Report - (Also described under Sales). Provides a summary of the lot, its age, its suggested selling price, an overview of the F.O.B. or consignment amount, delivery cost and total cost, quantities received, etc. Available even if lot is not completely sold.
  - Use: Provides a summary of the net profit/loss of a given lot and determines the accounts payable for consignments
  - Frequency: Daily or on request
  - Interfaces: sales, inventory, purchasing
  - Distribution: sales executive, buyer

Inputs:
Purchase Order Entry - This screen records all the key data elements (broker, buyer, commodities, ship date, due date, shipper's routing and related transportation information, remark on quality of goods, and receiving control information) attached to the order as a whole. Then the costs are recorded in detail (supplier, broker, quantity, cost and freight.) If consignment, handling amount and percent commission will be recorded.
  - Source: Buyer
  - Use: To enter purchase order and costing information.
  - Data Organization: By purchase order number, shipper, and commodity.
  - Frequency: Daily

NOTE:
Accounts payable requirements are not being elaborated upon here. The standard packages available in the software market place are sufficient to meet the requirements of most wholesalers. The links to the accounts payable from purchase and sales (on consignment entries) may be automatic.[5] Initially, however, internal auditing may prefer to see a manual posting to payables to allow the company time to absorb the change to a computer system.

Inventory Control—An inventory control system for the wholesale produce industry presents requirements quite different from those of most other industries because of the speed of transactions during the sales day, volatile prices, supply uncertainties, and a high turnover rate. Overselling by salesmen and inadequate lot tracking are two problems that are consistently present.

The core of the system is the lot accounting function. Simply stated, and with the exception of receipts from other wholesalers, each lot is assigned its own inventory account as it is received. All costs are associated with that lot and all sales are subsequently recorded against the lot along with inventory adjustments.

When the lot is sold out, accounting takes place on a lot basis, with reports showing the items that were sold, their prices, and a profit or loss figure for the lot as a whole.

The major requirement of inventory control is to provide reports which record the correct on hand quantities. The accuracy of the inventory reports can only be sustained by providing a capability which allows physical inventory to be updated on a daily basis.

Although inventory will be affected primarily by receipts and sales, an adjustment capability is also required to handle write offs and write ons, and to correct data entry errors.

Another requirement is for effective inventory valuation reports for audit control.

A final possible requirement for some wholesalers would be the capability to allow identification of key products and their special requirements for temperature control and handling during shipping.

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[5] Do not assume that the automatic link of standard accounts payable, accounts receivable, general ledger, and payroll application packages to an existing fruit and vegetable package will be easy to implement. Interfaces must be planned and verified to work.

Outputs:
- a. Lot Receipt Journal - Details each lot receipt or manifest and highlights the lot number, shipper, item, and quantity ordered.
  - Use: to verify lot receipts.
  - Frequency: daily
  - Interfaces: 1) purchasing, 2) inventory, 3) controller
  - Distribution: purchasing

- b. Available to Sell Report (Inventory Summary - also described under Sales) - Provides sales personnel with a confirmation of the stock on hand, date received, the price, description, and remarks such as "exceptional quality," " sell fast," etc.
  - Use: to report on-hand inventory and provide sales personnel with data on items available for sale.
  - Frequency: daily
  - Interfaces: sales, purchasing, and inventory
  - Distribution: sales personnel, buyers, inventory clerk

- c. Inventory Count Sheet - Provides the description and location of goods for physical counting.
  - Use: a document on which to record physical inventory and which in turn is used to update the inventory files
  - Frequency: daily
  - Interfaces: inventory control
  - Distribution: controller

- d. Purchase Order Discrepancy Report - Identifies the purchase order, broker, shipper, and all items related to receiving (temperature, comments, etc.), and then notes differences between order quantities and received quantities.
  - Use: to serve as a base document to review changes in orders between buyers and vendors.
  - Frequency: daily
  - Interfaces: Buyer, vendor, accounts payable, receiving
  - Distribution: Buyer

- e. Inventory Valuation Report - Shows the quantity and value of all items in inventory by warehouse location.
  - Use: as required by the controller to determine a financial value of inventory.
  - Frequency: monthly or on request
  - Interfaces: inventory control
  - Distribution: controller

Inputs:
- a. Lot Receipts - Enters incoming shipments into the system. Information from the manifest is entered and lot number(s) assigned.
  - Use: to receive the goods into inventory
  - Source: receiver
  - Data Organization: by lot number and item code
  - Frequency: daily

- b. Inventory adjustments - Identifies a product by lot and allows for all inventory movements except for sales and receipts. This includes lost or found goods, waste,theft, deterioration, customer returns, etc.
  - Source: inventory control clerk
  - Use: to keep computer calculated inventory in line with physical inventory
  - Data Organization: by item by lot
  - Frequency: as required

- c. Physical count entry - Allows for the entry of actual counts in inventory to balance the computer's on hand amount.
  - Source: inventory control clerk
  - Use: to reconcile the amounts for the "available to sell" and "inventory valuation" reports
  - Data Organization: by item by lot
  - Frequency: daily

Sales—The sales system information is comprised of the data on the sales tickets. Theoretically these inputs can be performed directly by the salesmen using terminals as they take telephone orders. However, few wholesalers, even the very large ones, use this method because of the reluctance of their older sales personnel. The common means is to have the sales ticket filled out first and then have the data entered directly from the tickets.

Once in the computer, the data from the tickets are processed, and the major sales reports can be generated. These include, but are not limited to, the sales journal and summary, available to sell report (inventory summary), and the lot profit and loss report. The pick list and adjustment reports also flow out of the sales ticket entry.

For decision support considerations, any number of sales reports could be generated from the system. These could highlight sales by commodities, by customers, and by salespersons for various time periods. They also could analyze profitability, growth, and percentage contribution for any of these categories. There is almost no limit to the number and type of sales analysis reports tailored to the needs of individual wholesalers.

Outputs:
- a. Sales Journal and Summary - the sales ticket number and customer dollar amount appear on this report for all daily sales.
  - Use: to audit and verify all sales transactions and to determine total amount of sales per day.
  - Frequency: daily
  - Interfaces: sales, audit
  - Distribution: sales executive, controller

b. Available to Sell Report (inventory summary -also described under Inventory Control) - Provides sales personnel with a confirmation of the stock on hand, date received, price, description, and remarks such as "exceptional quality," "sell fast," and so on.
  - Use: to report on hand inventory and provide salespersons with data on items available for sale.
  - Frequency: daily
  - Interfaces: sales, purchasing, inventory control
  - Distribution: sales personnel, buyers, inventory clerk.

c. Pick List - The item (commodity, brand, lot, size, and quantity) must be identified.
  - Use: these are the picking documents for delivery orders. They are also used as turn-around input documents to correct sales tickets if changes occur on the floor. These corrections affect billing and inventory.
  - Frequency: as required
  - Interfaces: shipping, sales
  - Distribution: shipping, data processing

d. Adjustments Report - Provides an audit of credits issued. It contains item description, lot quantity ordered, quantity returned, price adjustment, reason, and name of customer and sales person.
  - Use: auditing credits and customer returns adjustments
  - Frequency: daily or weekly
  - Interfaces: controller, sales
  - Distribution: controller

e. Lot Profit and Loss Report (also described under Purchase) - Provides a summary of the lot, its age, its suggested selling price, an overview of the F.O.B. or consignment amount, delivery cost and total cost, quantities received, and so on. Available even if lot is not completely sold.
  - Use: provides a summary of the net profit/loss of a given lot and determines the accounts payable for consignments.
  - Frequency: daily or on request
  - Interfaces: sales, inventory, and purchasing
  - Distribution: sales executive, buyer

f. Price Summary by Commodity by Lot - Shows sales by commodity within a lot at each selling price.
  - Use: to provide information on the price levels of sales for each commodity within a lot
  - Frequency: daily or as required
  - Interfaces: sales
  - Distribution: controller, sales executive

g. Sales Journal by Lot - Identifies the lot's sales history by key customer, quantities sold, date and price, including inventory adjustments.
  - Use: to provide at a glance all the transactions related to the lot
  - Frequency: daily as lots are closed, or on request
  - Interfaces: sales executive, inventory control
  - Distribution: controller

h. Key Customer by Commodity Report - Reviews a particular customer (or group of key customers) and their purchases over a variable time period.
  - Use: to determine net profitability by customer or customer group and to analyze such profitability by the commodities he trades in.
  - Frequency: on request
  - Interfaces: sales executive, sales personnel
  - Distribution: sales executive

i. Commodity Sales Report - Reports the sales by commodity and price, week to date, month to date, and year to date. Should also include profit/loss and totals for the period.
  - Use: to analyze the sales and profitability by commodity
  - Frequency: weekly, monthly
  - Interfaces: sales executive
  - Distribution: sales executive

j. Sales by Sales Personnel - Reports each salesperson's cash and credit sales, profitability, and percentage of total sales by week, month, and year to date.
  - Use: to monitor sales performance
  - Frequency: weekly, monthly, or as required
  - Interfaces: Sales
  - Distribution: sales executive

k. Product Report by Salesperson - Summarizes each salesperson's weekly, monthly, and year to date sales by commodity, quantity, price, and profitability.
  - Use: to monitor sales performance
  - Frequency: weekly, monthly, as required
  - Interfaces: sales
  - Distribution: sales executive

Inputs:

a) - Sales Ticket Entry - Perhaps the key element in the entire system, it is critical that the sales ticket be entered correctly. The customer I.D. number is entered and a credit check is performed. The customer's name and address should appear on the screen and detailed information for each item sold is entered. This should include lot number, quantity, and price. The computer will calculate the extensions and the total amount of the ticket.

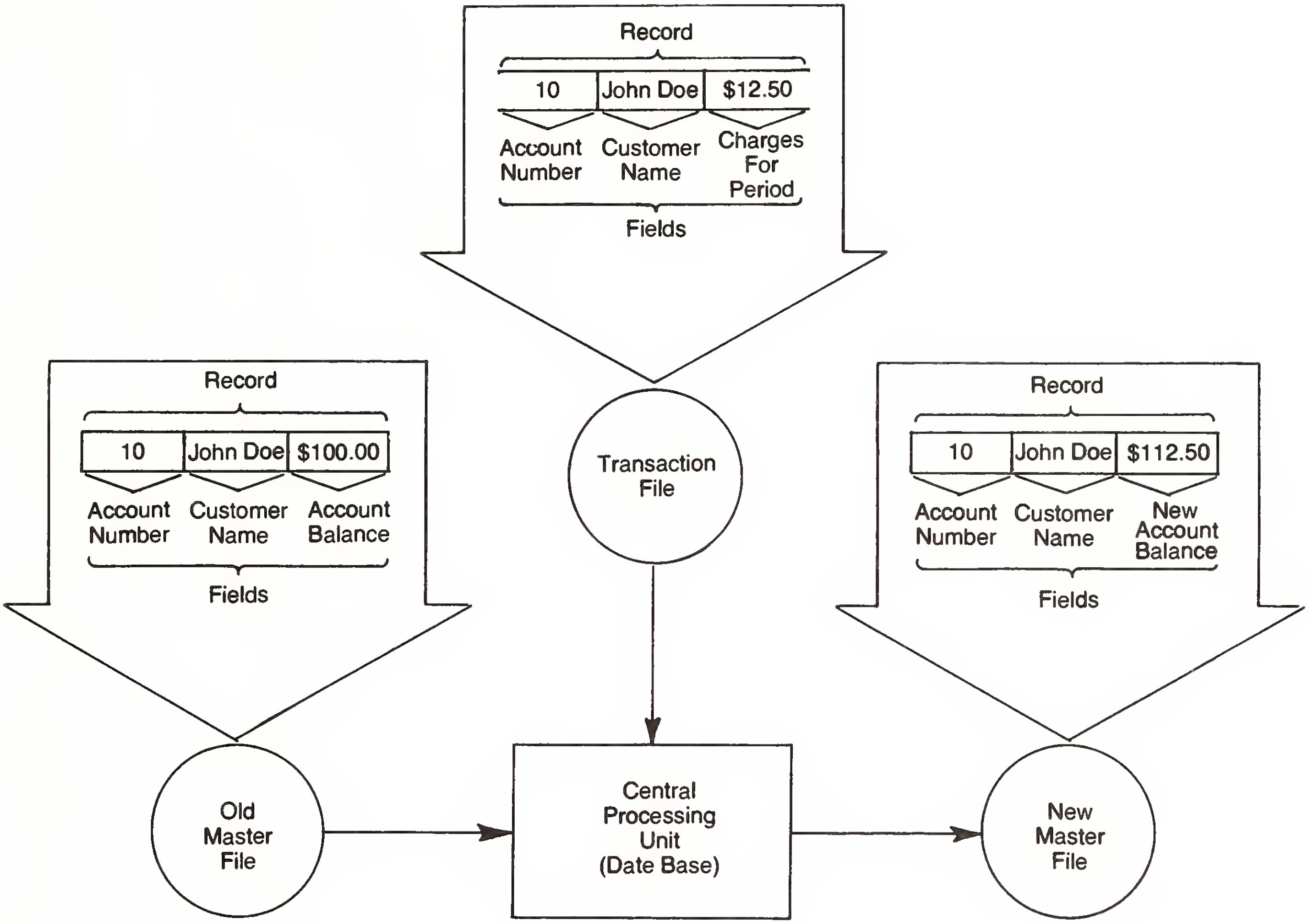

Figure 10.—Two basic types of files: (1) Master and (2) transaction.

Source: Sales Person or Order Entry Clerk
Data Organization: by commodity, by lot
Frequency: Daily

NOTE:
The accounts receivable function is fed by the sales function. Rather than specify in detail the requirements of a separate accounts receivable, most standard software packages will satisfy the requirements of the industry.[6] In fact, many of these standard packages have been installed in the industry. The major requirements are to find packages that can be adapted to 7-, 14-, and 21-day cycles.

The requirements for billing, credit checking, and maintaining customer records are also standard. The only requirement is the ability to print statements weekly.

Payroll—Most wholesalers studied employ 20 to 40 people.The payroll functions are standard and there is no need to elaborate on any special requirements of the industry.[7] Automation of the function at the present time is not a major concern.

General Ledger—Here again, there is no need to elaborate on the requirements for a general ledger system unique to the wholesale fruit and vegetable industry. A standard software package that is tailored to handle lot accounting data, and that provides a trial balance, profit and loss reports, and a balance sheet meets the requirements of the industry.[7]

Files Description

A computer file, like a paper file, is a repository of information. There are two basic types of files: master files and transaction files (fig. 10). A master file is usually a permanent file containing some data that are fairly constant and other data that are updated periodically. An example of a master file is a customer file, which has a data record for each customer. In the data record are some fairly constant data fields, such as customer number, customer name, and customer address. Also, some data in the data record are subject to periodic updating. Such data include the dollar amount due from the customer, and payments from the customer during the month.

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[6] See footnote 5.

[7] See footnote 5.

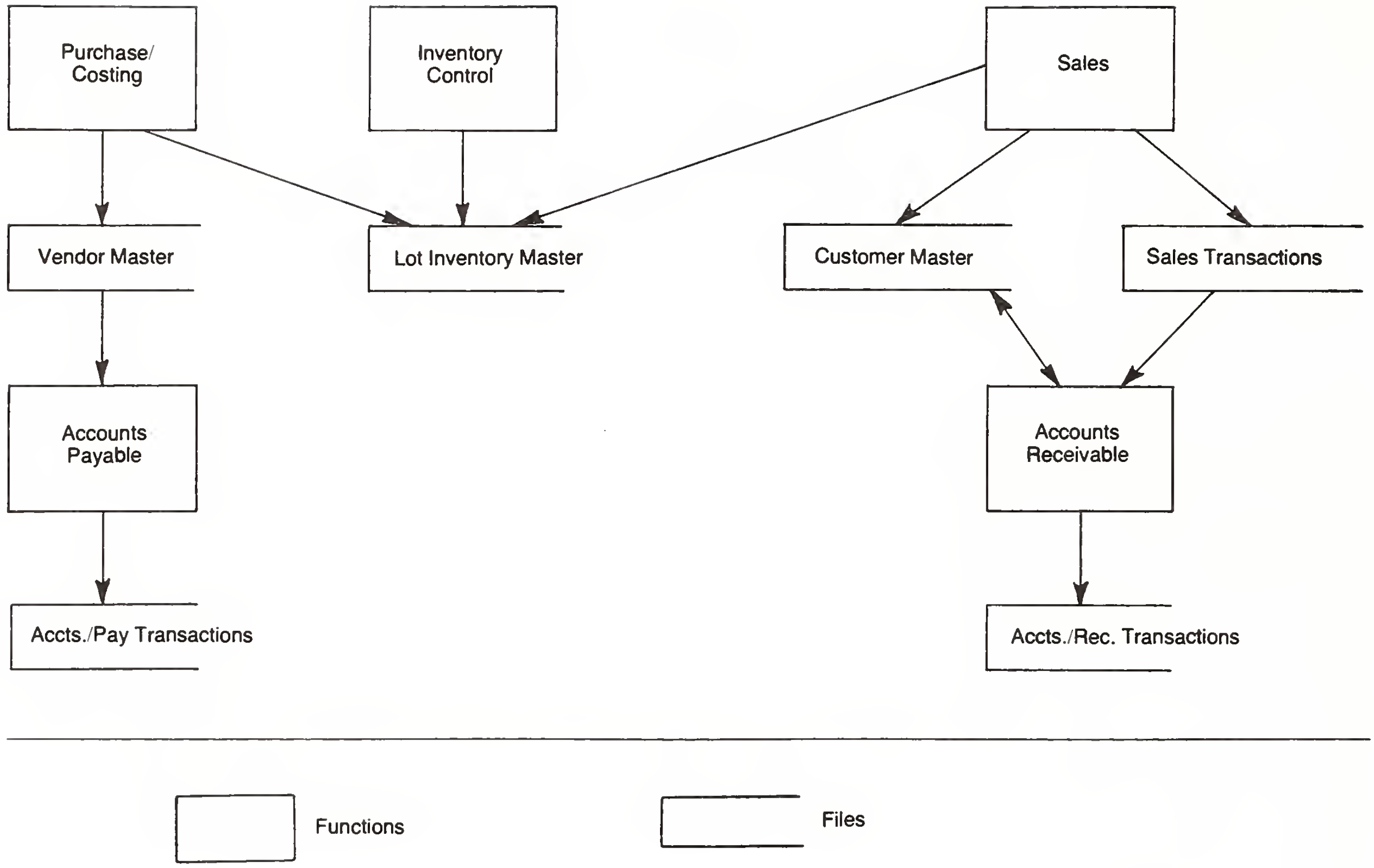

Figure 11.—The interrelationship of the major files with the primary functions they support.

A transaction file is usually a temporary file that holds data used to update master files. A sales ticket file is an example of a transaction file; it has a data record of all sales to each customer who has made credit charge purchases during a certain period. The computer processes the transaction file; this file is then used to update the customer's accounts, which are maintained in the master file. For example, the customer's balance due, as reflected in the master file, plus the new sales, as indicated in the transaction file, equals the customer's new balance due.

Although a transaction file is kept for certain periods of time to serve as an audit trail for accountability, it is also kept for specified periods of time as a history file to assist in backup to rebuild the data base if the computer loses files through breakdowns, electrical outages, and the like.

The major files involved in the system are closely linked to the functions they are required to support. A list of these files will include:

1. Customer master
2. Accounts receivable transactions
3. Sales ticket transactions
4. Lot inventory master
5. Vendor master
6. Accounts payable transactions
7. General ledger journal

Figure 11 shows the interrelationship of the major files with the primary functions they support. These files are separated here for illustrative purposes; but, in fact, they are components of an integrated data base.

The following requirements focus on the information that should be carried on file to support the primary functions of the company. They are not to be construed as an attempt to design these files in depth. Each wholesale company could define its data differently, adding or omitting information as determined by its unique situation. As the scope of a company's system increases, the amount and type of data stored will increase.

The following briefly describes the major files, their contents, purpose, and frequency of updating.

Customer Master—This file contains customer information. The sales transactions are linked to the customer file as are the accounts receivable transactions. It is updated as new customers are added, deleted, or have their addresses changed.

Contents:
- Customer number (a code to identify the customer)
- Customer name
- Customer address
- Contact person
- Credit limits (if necessary)
- Current balance

Other information may include zone location, delivery or pickup, type of business, size of business, annual totals of sales. As the decision support system grows over the years, additional fields can be added to analyze customers' buying habits, and/or profitability.

Use: To form the focal point for all customer related information that is needed for present operational support and for future decision support systems.
Update Frequency: As changes occur in the customer base.

Accounts Receivable Transactions—This file is to record amounts sold and billed, to record payments, customer returns, and selected financial transactions such as price adjustments.

Contents:
- Customer number
- Transaction type (sale, credit, payment, and the like.
- Date
- Amount
- Transaction reference
- Comments

Use: To track the amounts due the wholesaler by each customer.
Update Frequency: Daily or weekly. These files are condensed after the statements are printed.

Sales Ticket Transactions—The sales tickets record each sales transaction. They must be maintained on file until the goods are shipped, inventory updated, and the transaction linked to the accounts receivable functions.

Contents:
- Customer number
- Type of sale (cash/credit)
- Ticket number
- Date
- Salesman
- Item description (includes lot number)
- Quantity
- Price

Use: To record the sales transactions and hold them for updating accounts receivable and inventory.
Update frequency: Daily

Lot Inventory Master—This maintains a computerized record of all the manifests. It contains the quantities received and the costs related to each shipment.

Contents:
- Purchase order number
- Manifest number
- Shipment number
- Lot number
- Purchase or consignment
- Percentage commission on consignments
- Cost information (freight, handling ice, cartage, and similar items.
- Date
- Item description (item, brand, size, and so on.)
- F.O.B. cost per item
- Quantity delivered
- On hand quantity

Use: These files are used to record each shipment as it comes in. As sales occur, each lot is depleted until it is completely sold. Reports are then generated for each closed lot to provide basic lot accounting information.
Update frequency: Manifests are added to the file daily. Updates take place as sales occur until the lot is depleted.

Vendor Master—This records the names of shippers and growers who account for the bulk of the accounts payable transactions.

Contents:
- Vendor number
- Vendor name
- Contact person
- Address
- Telephone number
- Bill to address
- Current balance

Use: To maintain information on vendors including their current accounts payable balance.
Update frequency: Daily as purchases are billed, consignments sold, payments made, and vendors added or deleted.

Accounts Payable Transactions—This file is used to record the information on bills to be paid, and the transactions (checks, credits, and so on) that apply to these bills.

Contents:
- Vendor number
- Date
- Amount
- Transaction reference
- Comments

Use: To keep track of the accounts payable
Update frequency: Daily, as lots are closed (consignments) or as goods are bought (purchases).

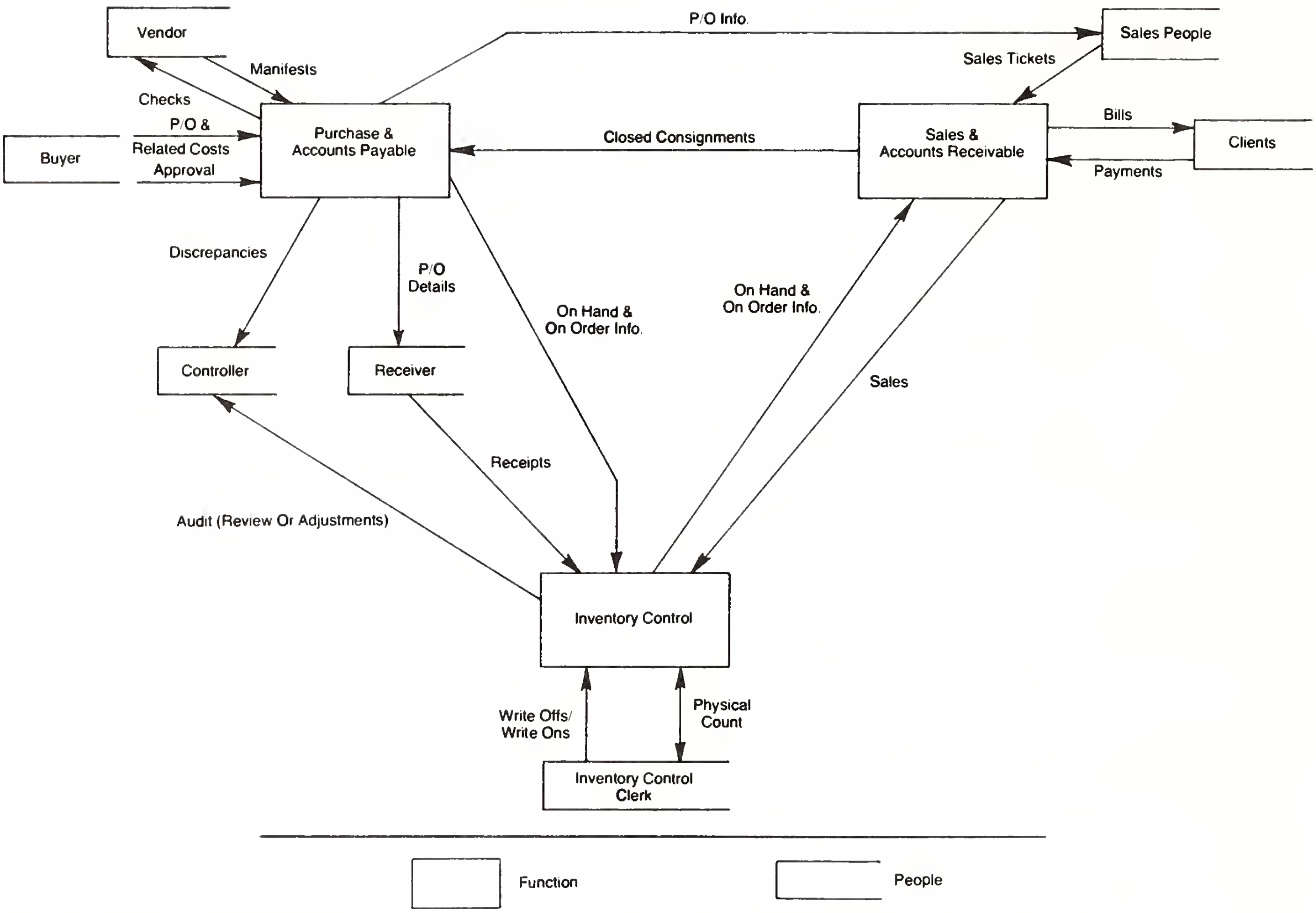

Figure 12.—Required basic system data flow by function and personnel involved.

General Ledger and Payroll—[8]Because the standard software packages available for general ledger and payroll provide full information on their file structure, descriptions of these files are not included here. There are many structural variations available.

Proposed System Data Flow Overview

Figure 12 shows the required basic system data flow by function and personnel involved.

Once the master files discussed above have been loaded initially, the system should operate as a mirror image of all transactions that occur in the company. The process is circular in that, at any one time, all these transactions will be occurring at once.

On the purchasing side, everything begins with the purchase order, which is priced as completely as possible and processed internally. When the goods arrive, they are verified against the manifest and the purchase order, discrepancy reports are sent to the auditors, and inventory is updated. Checks are issued upon receipt of bill from vendor (purchases) or upon sale of lot (consignments).

Before sales begin, salespersons will update prices for each item on hand or on order. As sales tickets are processed, inventory is updated as are the accounts receivable to be processed through the invoicing statements, and aging modules.

Inventory control involves the maintenance of journals which allow control and costing of the goods on hand. Adjustments are entered and audit reports printed as required.

Validation

Under current manual procedures, extensive reconciliation must take place at the end of each day to ensure that the balances of sales calculated from sales tickets equal those calculated from manifests, inventory records, and other internal documents.

With a computer system, validation takes place at the time of system testing, during the initial stages of implementation. The need for extensive validation thereafter should be limited to verifying the inputs to the computer before entering them.

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[8] See footnote 5.

Security, Privacy, and Control

A computer system should be secure against physical damage, loss of data, and unauthorized access. The principal question wholesalers must address is: What are the consequences to the company if proper protection is not provided? There is a tradeoff between the amount of security provided and the additional costs to provide it. There is also a tradeoff between the amount of security provided and the increased regulations and procedures it would demand.

Although the wholesale fruit and vegetable industry has no need to be overly cautious, there are some basic requirements that should be met.

Physical security should consist of adequate safeguards against illegal entry of the premises and emergency procedures for fire, smoke, electrical outages, and air-conditioning breakdown.

Data security should consist of a daily backup of computer files on tape or disk to minimize recovery procedures in the event of data loss, and storage of confidential data on tapes or disks in a locked enclosure. Backup disks and/or tapes should be kept off premises to assure their security in the event of fire or other catastrophe on premises. Company procedures should assure that personnel are aware of adequate manual procedures in the event of a breakdown of the system.

Access security should consist of password control at two major levels—the system level and the function level. At the system level, only the systems manager and top executives should have access to key passwords. At the function level, each program or module should be under password protection.

Planning and designing for privacy and security should be a joint function of top management, accounting, and data processing personnel, possibly with the advice of outside experts. This approach can be broken into four steps:

1. Identify assets that would suffer most from a breach of security and rank them by their importance to the company's well being.
2. Identify and evaluate potential security threats.
3. Assess the probability of each kind of threat.
4. Institute a set of controls within the budget to minimize both the probability and the severity of damage.

No security system is perfect and no budget unlimited, so it is important that alternatives be carefully evaluated from the standpoint of the degree of risk and the importance of a violation to the existence of the company.

Human Considerations

People represent the key element in the wholesale produce business and generally constitute one of the largest single costs of operations. Motivating people is particularly important, since highly motivated employees are important sources of creative ideas, improved productivity, good customer relations, and ultimately, an effective organization. In contrast, if employees are not positively motivated, it is very difficult for a wholesale company to attain its desired level of effectiveness.

Traditionally, computer system concepts have depended greatly on the technical approach. This approach emphasized rationality as the basis for problem solving and was needed to overcome personal biases, laziness, or ignorance. It also helped reduce the degree of uncertainty in the decision making process. Unfortunately, however, much of this technical effort has severely neglected the human factors, even though people are vital elements in the business.

Since the strictly rational approach to systems has not been entirely satisfactory, human considerations are consequently getting increased attention, even if these considerations do spoil those solutions that appear so ideally rational on paper.

For a successful computer implementation, a balanced approach toward both technical and human considerations is required. The following is a brief list of recommendations that need to be addressed before implementation of a computer system commences:

- Start small. Don't overwhelm employees with a vast companywide change.
- Introduce the new technology only into those areas where benefits are immediately needed and will be immediately evident.
- Present the new system as an aid to increased productivity and personal effectiveness, and not as a replacement for the present staff.
- Select a system that is compatible with the needs and preference of the employees who will use it.
- Consult with employees before making a purchase decision, and allow them to have a say in the system they will be using.
- Provide training in the use of the new system both during and after the introduction phase. Don't expect the training provided by the vendor to be totally adequate. Employees, for instance, need to know the relationship between computer automation and their career advancement. They need to be prepared for procedural changes and some reorganization. They need to see how the pieces fit together and where there are important payoffs to the wholesaler and themselves. The timing of training can be more important than the amount

at the outset. Train only for that part of the system that individual employees need to know and only when they need to know it. Train a little bit at a time.
- Appreciate the initial resistance some employees will reflect. This will probably be more apparent with older workers who are more accustomed to the old manual methods and will be most resistant to change.
- Be aware of the need for ergonomic integration with the new technology. Ergonomics, the study of the relationship between humans and machinery, is a relatively new development in the office technology field. Office workers, the theory goes, will offer less resistance to products designed to be more compatible with human needs. Examples of this type of design might include tiltable video screens, screens adjustable for brightness, terminal keyboards that are detached and completely independent from the screen, proper lighting, and comfortable computer desks and chairs to minimize physical and mental fatigue.

Future Considerations

An inevitable development in the near future is a proliferation of computer solutions to meet the requirements of the wholesale produce industry. Once these systems become installed, the demand for increased decision support systems will continue. These will focus on gaining more information on profitable commodities, seasonality, and additional customer information. They will also provide wholesalers with the capability to perform product movement analysis for key customers and thus increase the value of their services.

In the next decade, the explosive growth of computers and the rising growth and reduction in cost of centralized communication networks could result in a nationwide network of wholesalers, shippers, and growers who will coordinate their buying and shipping via electronic marketing systems. These systems are presently experimental, but appear to be technically feasible. Their success will depend very much on the attitude of the parties involved to operate in a revolutionary system that will drastically change the marketing customs which have existed for many years.

It is difficult to imagine at this point the transition from the very personal use of the telephone for buying and selling to the use of electronic marketing through vast computer networks. However, the industry shifted to the telephone itself only 40 or 50 years ago.

It remains unclear whether the economics, the speed of the transactions within the industry, and the human considerations will warrant the establishment of a computer network for electronic marketing similar to those that are being established for other commodities.

General Objectives of a Proposed System

The objectives of a proposed computer system for mid-sized ($10 - $20 million) fruit and vegetable wholesalers are twofold:

1. Less paperwork, fewer labor intensive functions, and faster, more accurate, and more productive processing of daily transactions. At the operations level, everything should flow more smoothly because information is more timely, more automatic. Labor should be shifted from mundane clerical tasks to more productive management and sales- oriented ones.
2. More accurate and sophisticated management information to the firms executives. Resources should now be available to prepare and analyze the comprehensive sales reports; for example, by salesman, by commodity, by customer, by lot profitability, and similar means. Most firms do not presently have the resources to prepare these decision support reports, and even if they provided the manpower, the accuracy of the information would be in question. The only way to ensure accuracy is to provide a comprehensive system that will validate the data as they are processed. Once these data are available, the executive has the ability to review all aspects of the operation and to extract reports from the data base on an ad hoc basis.

According to a Pennsylvania wholesaler who has successfully implemented a computer system: "Let wholesalers know that computers will not save money by getting rid of employees. Money is made on analysis and reports. Computers will help to substantiate the results of wholesalers' knowledge."

Alternative Systems Analysis

This section of the report describes three alternative operational systems, analyzes their impact, and discusses system implementation, software vendor selection, computer documentation, and computer system maintenance contracts.

In addition to the continuance of the current manual system (alternative one), there are two distinct computer alternatives: A super microcomputer system (alternative two) and a minicomputer data base system (alternative three).

Both computer alternatives are technically and operationally feasible. That is, they have the capability of meeting wholesalers' basic requirements with presently available technology, and have the ability to fit the operational pattern and resources of the wholesale firms for which they are recommended.

Both systems also satisfy the main requirement referred to earlier in this report. That is, they integrate the major functions of the business into a data base maintained in real time, with concurrent access and update capability.[9] [10]

Although a broad spectrum of hardware is available for the two computerized systems, the focus here will be on a single hypothetical configuration for each that will initially satisfy the average wholesale firm for which they are recommended. The number of terminals and printers can, however, vary according to requirements of individual wholesalers, as can the sophistication of the software. These systems are very flexible.

Both computer alternatives use integrated software packages. Integrated software can be simply explained as the merging of two or more application programs[11] into a whole, workable, and interactive system. Each application has its own independent capabilities; however, it is integrated into a system through the use of such internal tools as common data sharing and storage. With integrated software, a user can step from one function to another without any visibile internal processing changes, and little or no change for external entry and prompting requirements. Data such as sales ticket information need be entered only once, and other appropriate related files, such as inventory and receivables, are updated automatically. The benefits are obvious. The data entry error probability is reduced, and so is the time-consuming task of assuring that all related files are updated.

The software should be easy to learn, easy to use, and easy to modify. It will be the interface between the computer and the wholesaler. Therefore, it is necessary that both management and operational staff have a clear idea of how the software operates and how data are stored in the data base.

Both computer alternatives have built-in security features to prevent unauthorized access and are based on password protection which satisfies the security requirements discussed earlier in this report.

Alternative One: Continuance of Current Manual System

The current manual system has been described in detail earlier in this report. The general components of the system should be reviewed as thoroughly as the present section to understand how a computerized operation can be of great advantage to the wholesaler.

With the current manual system, much of the essential data relating to purchase/costing, inventory control, and sales is processed by use of handwritten paper forms and often only small scraps of paper. Errors are frequent, and only a complex system of checks and balances at the end of the accounting day assures basically balanced books.

With the current system, involvement of senior personnel in clerical matters is necessary and time consuming. Functional areas such as inventory are out of balance continually. And, although certain reports such as lot summaries, sales, and receiving journals are available, other important sales statistics are generally not prepared because of the time delays, costs, and high probability of error.

Alternative Two: Super Microcomputer System

Super microcomputers are presently the most advanced technology available in microcomputers. They can be described with two terms: multitasking and multiuser.

Multitasking means that the computer can perform more than one task at the same time. For example, inventory control functions can be carried out at the same time as a sales analysis function is being processed.

Multiuser means that at least two users can be operating the computer at the same time using separate terminals hooked into the same central processing unit.

Compared with conventional microcomputers, a super micro computer is substantially more powerful in that it contains more memory, supports more terminals and printers, and processes data two to three times faster.

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[9] See footnote 2.

[10] See footnote 3.

[11] An application program is software which directs the computer to perform a specific series of operations such as updating inventory records or processing accounts receivable.

The recommended application software emphasizes inventory control, sales processing and reporting. Purchase/costing is only slightly covered. However, as the wholesaler requirements demand it, additional software can be added.

The system is relatively simple and parallels most of the current manual procedures. The "upstairs" staff is usually the only personnel of the business directly affected. It will fit easily within the operations of wholesalers who have had limited or no experience with a computer system. Most of the requirements discussed earlier in the report will be satisfied.

The system is recommended for wholesale companies who do not desire to significantly alter their internal operations, who need to improve the speed and accuracy of their daily transactions, have an average need for decision support information at the present time, and don't expect annual sales to exceed $30 to $35 million within the next 4 or 5 years.

Improvements—The super micro computer system should satisfy the general objectives of a proposed system as outlined earlier in the report. There should be less labor-intensive functions, and faster, more accurate, and more productive processing of daily transactions. In addition, there should be more accurate and sophisticated management information (decision support) provided to the firms' executives.

The time needed to produce lot accounting reports at the end of the day will be greatly reduced and will not require the extensive manual operations currently used. Results should be available as soon as the selling day is over.

The system allows the wholesaler to grow substantially in sales volume without expending additional resources in staffing. In addition, as senior management recognizes the usefulness of decision support reports, they may purchase a report generator, which gives them the capability of extracting additional information from the computer without having to pay a programmer.

Where a wholesaler has split facilities and desires to maintain a direct link with the main computer, he can consider linking the terminal(s) in the remote location through modems [12] and a dedicated line or standard telephone cable.

Impacts—The following describes the anticipated impacts of installing the super microcomputer system.

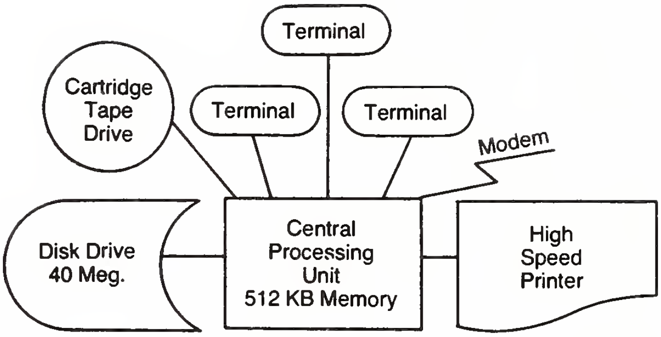

Figure 13.—Sample configuration of super microcomputer system in main office.

Equipment (hardware).—Figure 13 illustrates a sample configuration that will satisfy the needs of most medium size wholesalers. It is comprised of the following:

- 512Kb super microcomputer with four ports for printer and terminals (additional ports can be added if required.)
- Three terminals.
- One high-speed printer.
- One hard disk drive with 40 megabytes of storage.
- One cartridge tape drive
- One modem

This system is expandable to well beyond the requirements of the mid-size wholesaler.

Software.—Figure 14 illustrates the essential components of the application software. [13]It meets the requirements for sales and inventory control. The suggested functions of purchase/costing have been limited to tracking costs by lot. This option is intended to keep the costing process simplified, and yet satisfy wholesalers basic needs. A full description of the inputs and outputs has been included in the "Requirements Analysis" section of this report.

Organizational.—Installation of the computer system requires that the staff working with the computer become aware of all facets of its operation. They should not only learn to operate the computer with respect to the jobs they handled before, but should also be capable of backup procedures, starting the machine and turning it off, changing paper, understanding the types of errors that may occur and personnel to call in case of failure. At least one person from the wholesale firm must be trained to run all the equipment and coordinate the activities of all those that interact with the computer.

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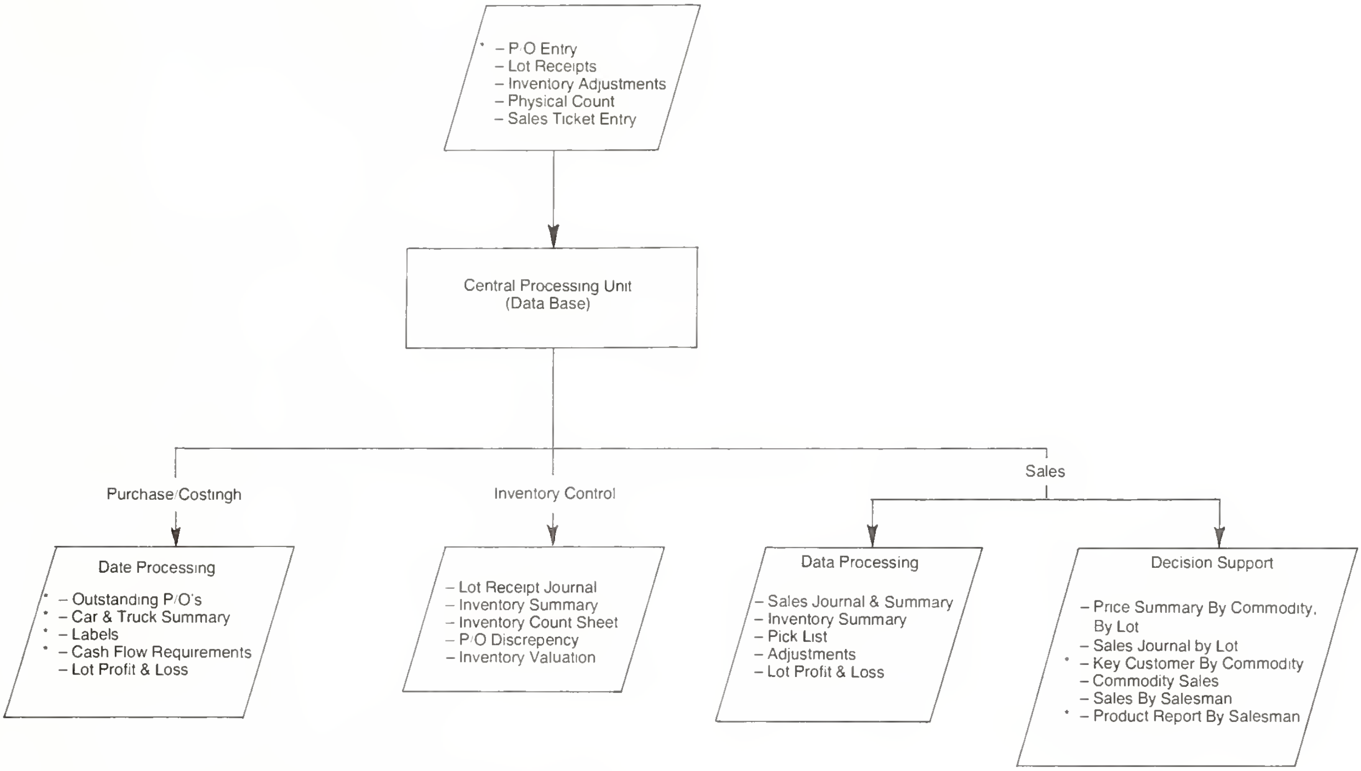
[12] A modem is a device that provides the compatibility of data processing devices and communications facilities; that is, it allows computers access to telephone systems.

[13] Accounts payable, accounts receivable, and general ledger are not shown here. However, they are included in both the super micro and the mini data base systems. Payroll software is not included for either system, but may be added if desired.



*Not Included In The Supermicro System, But May Be Added At A Later Date If Desired

Figure 14.—Inputs and outputs of the super micro and mini data base systems for the three major functions of the wholesaler: (1) Purchase/costing; (2) inventory control; and (3) sales.

Facility.—No major office design changes are needed to install this system. However, a dedicated power line, voltage fluctuation control, adequate room temperature control, and a dust free environment are required.

Alternative Three: Minicomputer Data Base System

The minicomputer system is larger and more powerful than the micro system. Its increased capabilities enable many more variations and simultaneous combinations than the super microcomputer. Its increased capacity includes higher operating speed, more internal memory, and the ability to handle many additional terminals. The system can automate most informational aspects of the business, link them through the data base, and handle sales volumes of over $l00 million. This system should satisfy the requirements of the larger and more sophisticated wholesaler. Previous computer experience would not only ease the transition to the mini system, but is considered a requisite. Because this system will affect every department of the company, the wholesaler must recognize the need to discipline the office procedures to provide accurate statistics on profitability, costs, product analysis, customers, sales personnel, and other important decision support information.

The system requires a detailed approach to implementation including training of office staff as well as receivers, sales and other personnel. Modification of present internal procedures and development of new procedures will be extensive. The financial and personnel resources required will be substantially greater than those for alternative two, the super micro.

The system is recommended for the high-end wholesaler whose sales volume exceeds $20 million, who has had computer experience, and who expects annual sales over the next 4 or 5 years to exceed $30 to $35 million.

Improvements—In addition to the improvements discussed for the super micro computer system, other improvements should be realized with the mini system.

The major improvement over the super microcomputer is the extension of computer power out of the "upstairs" office into the operational areas, covering most aspects of the business. The mini system can handle many more terminals, process a far larger number of transactions, and allow for more functions to be processed at the same time.

The second area of improvement is in strategic business planning utilizing the system's superior decision support capability. For example, the software of the mini system covers more aspects of the purchasing function, thus providing the capability of maintaining statistics on the costs of a single carton of fruits and vegetables. In the sales reports, this capability provides more detailed analysis of profitability (by customer, commodity, and salesman) because of a more detailed breakdown of all costs such as freight, Ryan, inspection, icing, and so on. For sales management, the availability of a complete data base of sales information available instantly on the terminal will allow for rapid adjustment to changing market conditions.

The third key improvement is in the more complete institution of automated controls. The mini system extends ap plications significantly beyond those of the micro system such as controls over inventory, receivables, and payables. For example, all manifests are compared with purchase orders on the computer and discrepencies noted. All manifests must be received and approved by the buyer and the accounts payable department on the computer stored manifest file before payment. Inventory control can include transfers between the wholesaler's warehouses where applicable, and customer shipments and returns to a greater extent than in the micro system.

Impacts—The following describes the anticipated impacts of installing the minicomputer data base system.

Equipment (hardware).—Figure 15 illustrates a sample configuration that will satisfy the initial needs of most larger wholesalers (over $30 million in annual sales) or those upper end mid-sized wholesalers (over $20 million in annual sales) who expect substantial growth in the next few years. It is comprised of the following :

- One megabyte minicomputer with seven ports for terminals and printers (additional ports can be added if required.)
- Five terminals including the systems console terminal
- Two printers
  One high speed for all major reports.
  One low speed to print invoices on the sales floor.
- Two hard disk drives with 55 megabytes each of storage.
- One tape drive.
- One modem

With the larger minicomputer system comes additional terminals and printers not only in the office but also those connected by cables to the selling floor, the warehouse, and the receiving areas.

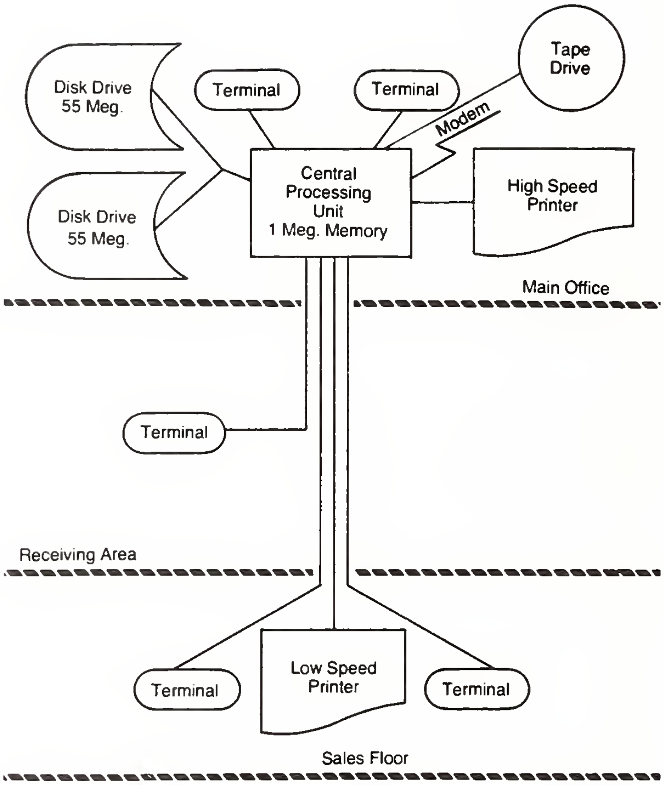


Figure 15.—Sample configuration of mini data base system

Software.—Figure 14 illustrates the essential components of the application software.[14] It meets all the requirements for purchase/costing, inventory control, and sales. Unlike the super microcomputer system, the mini software satisfies all of the requirements of the purchase/costing function explained earlier in the Requirements Analysis section. It also contains additional sales reports with improved profitability reporting, which is made possible by the improved costing procedures.

Communication services are provided using the electronic mail capability of the system to send and receive messages by key operations staff.

The purchasing function also includes the capability of creating purchase orders, matching manifests for the purchase orders on-line, entry of buyer approvals, and interwarehouse transfers for the wholesaler who has split facilities.

This system's data base will result in efficiencies in its operating speed, and like the super microcomputer system, this data base offers report facilities that do not require the assistance of a programmer.

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[14] See footnote 13.

Organizational—Organizational impact will be significant. A data processing department must be added to all organizational considerations, since it will now become a key part of full-time strategic planning. As with the micro system, at least one person from the wholesale firm must be trained to run the equipment and coordinate the activities of all those that interact with the computer. The Data Processing Department will be staffed by at least one part-time technically trained operator who will be responsible for maintenance, file backup, and distribution of reports.

The flow of timely management reports from the computer will free clerical personnel for other tasks and reduce the need for repetitive error checking. The computer will provide totals through sales and financial reports.

The staff must develop additional skills associated with the management of computer tasks. The procedures for file retention and computer maintenance must be learned. Data entry and inquiry skills on the computer must also be acquired.

To sum up, the most visible impact in the organization will be the creation of a data processing department consisting of one or more people. More subtle changes will occur later in the organization as management becomes more analytically oriented in its planning. Again, training people to use the software effectively is a major task and must be undertaken on a "department by department" basis.

Facility.—An area must be prepared for the computer and its peripherals. Although it is not necessary to construct a separate room, it is being recommended to protect the equipment from dust, dirt, and climatic influences which could shorten the equipment's useful life or create additional repair costs. Therefore, a room of approximately 75 square feet should be constructed or converted for the computer and its peripherals. It should consist of antistatic raised flooring, air-conditioning, ducting, dedicated electrical circuit, glass enclosure, and security locks. A separate voltage fluctuation control is not required because it is included with the minicomputer hardware.

Implementation

Implementing a computer system is an important part of acquisition, and should be done carefully. Human and technical considerations are critical at this stage; and despite the quality of the hardware and software, the success of the system will depend heavily on how this final process is conducted.

As with the introduction of any new concept into an organization, senior management support is crucial in assuring employees who are affected that this phase is important not only to the company's success, but also to their individual careers as well.

As mentioned earlier under the "Requirements Analysis" section of this report, affected employees should be kept aware of management's intentions; and should have the opportunity to discuss their opinions, concerns, and reactions openly with management.

In addition, with the implementation of a computer system, allowances need to be made for a "learning curve." That is, when a new technology is introduced, it is expected that productivity will decrease initially until personnel have become competent at dealing with and controlling the technology. With the introduction of a computer system, one should expect a period of a year or more from date of installation until the system (including personnel) is performing as desired.

There will probably be periods of frustration on the part of management and/or employees, particularly during the early stages of transition from manual to computerized operations. There are no set procedures for a successful implementation. The process will vary according to the vendor chosen, the system purchased, and the wholesaler's priorities. However, with the full cooperation and patience of the vendor, senior management, employees, and a consultant (if desired), a successful computer transition should evolve.

Choosing the Software Vendor

No wholesaler purchasing a computer system should first purchase the hardware independently in anticipation of later selecting, purchasing, or developing the software. As suggested in the"Background" section of this report, wholesalers need to determine their application software requirements[15] *before* deciding on the hardware. In effect, most software vendors develop their software packages to operate compatibly with specific hardware. Therefore, the first step is for the wholesalers to determine the choice of a software vendor.

Even if the wholesaler has already become familiar with a particular software package available in the marketplace which satisfies his requirements, it is critical to verify the credentials of prospective vendors who are selling these products. The quality of a good computer system does not necessarily guarantee the quality of the service provided by the vendor. Although the verification process is relatively simple, many wholesalers who have unsuccessfully implemented a computer system failed to evaluate their vendors beforehand.

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[15] See "Requirements Analysis" section.

Regarding the stability and depth of a vendor's organization, the following questions should be asked:

- How long has the organization been in business? If it has existed for a number of years, the chances for continuing in business are better than those of a fledgling organization. This is also true for the manufacturers of the hardware for which the software is designed.
- How many people do they have in their organization? An organization with 20 people comprised of only 10 workers with 10 managers is less likely to provide the depth of service and support than an organization with 15 workers and 5 managers.
- Does the wholesaler expect to have additional customizing (programming) done for the system? The answer here is definitely affirmative. Despite some vendors' claims of providing a turnkey[16] system, virtually all systems that have been successfully incorporated in wholesale produce companies have required additional customization. This has been true not only to satisfy individual wholesaler's unique initial requirements, but also to provide additional tailoring as the wholesaler's requirements change and grow. With this need for additional tailoring, it should be determined if the vendor's organization has provided this support before, and for whom. References need to be checked out to determine the length of time the vendor took to get the job done, their accuracy in meeting deadlines, and whether they provided a serious schedule which they were able to meet.

One way to check out a vendor's package is from demonstrations. Does the system satisfy the wholesaler's requirements? It may do more; however, one should make sure it does at least what is required.

Is the system easy to use? In addition to watching, use the keyboard for a "hands-on" demonstration. Be aware of the potential simplicity with which employees (and management) can get their work done. This is a feature which should be compared as prospective vendor selection takes place.

While demonstrations are an important yardstick for measuring the product, they do not serve to show the product's total capabilities. The only way this can be determined is to speak with other wholesalers who are currently using it. The most important homework a wholesaler can do is to check carefully the references supplied by the vendor. Don't settle for just one or two. Although, realistically, some excellent vendors have implementations in only one or two wholesale produce firms and cannot provide additional references, wholesalers should attempt to obtain at least a half-dozen and be certain that these references have systems similar to the one being examined. This important step, because it takes time and energy, is most often omitted.

It is preferable that the wholesaler go to customer sites and see the system in action. Ask all pertinent questions and get, first-hand,the thoughts and feelings of those who are using the system and who are working with the vendor's representative(s).

Whether in person or over the phone, find out what problems they had in the beginning? Do they have any now? What are they? What impact have these problems had on the daily production work or decision support? How do the vendor's represenatives get along with the user's personnel? Do they seem to know their product thoroughly, and can they communicate clearly with the user? How long did it take to learn the system well enough to become productive? Was their work seriously disrupted and for how long?

All of the previous questions can be summarized as follows:

- Does the vendor know the wholesale fruit and vegetable business, and does his product satisfy the wholesaler's requirements?
- Does the vendor know how to manage the installation and training for a wholesale organization?
- Does the vendor appear to be a stable and good risk?
- Does the wholesaler get a good feeling about the potential working relationship he and his staff will have with the vendor?

This careful checking with the current users of the vendor's system is the best insurance policy the wholesaler can take out. Over the life of the computer system, this initial effort will pay for itself many times over.

Documentation for the Wholesaler

There is no area more seriously neglected by the suppliers of computer systems than that of documentation. One of the most important questions to ask each potential vendor and each of his reference accounts is "What type of documentation comes with the system?" The degree to which wholesalers are supplied adequate documentation is the degree to which they will have confidence in the system and smooth daily operations.

There are several levels of documentation for any system. The first is frequently referred to as the "system overview." This level provides a flow of the entire system; that is, how the overall system works together to perform the many job functions of the organization. Each segment of the system is then taken separately and described functionally. This most frequently includes a general description of each function, the input that is expected by the computer at each step, and the output that the worker can expect to receive at various times throughout the use of that program. Some description should also be provided of the layout of the files and the records that are kept in each file.

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[16] A computer system that is ready to operate immediately after installation with little or no tailoring to individual wholesaler's requirements.

A second level of documentation is known as the "programmer's reference" or "source code." This level is least likely to be supplied to the wholesaler. It is a technical level of documentation that is provided for the programmer who is responsible for supporting and maintaining the software. It is meant to provide in depth descriptions of logic flow and coding (programming) that constitute the system, and it is not likely that the wholesaler will be provided with this level of documentation if the software was purchased commercially (off the shelf). Even if there's a possibility that the vendor will go out of business and leave the wholesaler with no support, this documentation is considered to be proprietary and not available to the buyer. If the software was written in an industry standard language (which is definitely recommended), and if the system overview documentation was properly provided, the wholesaler should be properly protected. However, it is strongly recommended, as part of the computer purchase contract, that the source code be placed in trust in the event that the vendor goes out of business or does not fulfill his contract responsibilities.

The most important documentation for the computer system is known as "user documentation." This level of documentation is most critical on a day-to-day basis. It provides the personnel using the computer system with the detailed step-by-step procedures that must be executed to perform each job function. In addition to a complete description of all job steps in each functional area of the system, optional responses are described that can be made by the person at the terminal or work station. Error conditions and corrections should also be described so that the worker can become truly independent after a reasonable training period. User documentation is a ready working tool that should be available at all times.

In addition to "user documentation," there will always be additional procedures that personnel will (or should) add gradually to the existing manual to use as a quick reference to simplify daily operations. These might include procedures that are frequently done, such as start of the day steps, end of the month jobs, backup procedures, and so on. They also might include more difficult procedures such as setting up checks for payroll (if desired) and accounts payable.

With all these items, a sample computer run should be performed and every step written with samples to show what is expected as output. If there are optional procedures to take, each option should be shown with a total set of steps for that option and the expected output. Each routine should be documented to the last detail. Anyone picking it up should be able to follow the directions without asking for additional help. In this way, no one individual becomes indispensable to the organization.

It is recognized that the above suggestions will not be fully accepted or implemented by many wholesalers and/or their personnel. Many vendors and consultants will not make these suggestions. However, senior management should instill this type of discipline into their operations if they desire to maintain reasonable independence from any one individual from within the firm, and from excessive reliance (at a cost) on outside support.

Computer System Maintenance (Service) Contracts

No one maintenance contract is best for every wholesaler. When purchasing a computer system, choosing and negotiating the maintenance contract can be as important as choosing the system.

The two most common maintenance agreements are "fixed fee" and "time and materials" contracts. In the first, maintenance and services are provided for a flat fee fixed in advance and paid on a monthly or yearly basis. In the second, wholesalers are charged for each service call, usually on an hourly basis, as well as for all replacement parts. Because there is no ceiling on costs, the "time and materials" contract can be risky and is not recommended for most wholesalers, at least not initially.

Options are also available for choosing between separate contracts with the equipment manufacturer and the software vendor or from a single source that will service both hardware and software. Each arrangement has advantages. The equipment manufacturer normally might know its particular equipment better and have greater access to the latest engineering changes. Parts may also be more readily available from the manufacturer. Single source maintenance is usually performed through a third party or the software vendor, and is often less expensive than separate contracts. A third party single source may also provide greater flexibility in negotiations. However, the primary advantage of a single source of service for both hardware and software is to avoid confusion which often develops when controversy arises as to whether the problem is related to hardware or software. Single source service contractors are recommended primarily for this reason.

The best time to negotiate the maintenance contract is before or at the time the system is purchased. Negotiating leverage often deteriorates quickly after purchase of the system. Whenever possible, maintenance provisions should be tied into the purchase itself.

If the contract is not tied directly with the purchase of the system, there should be several specific points negotiated. First, neither the purchase nor the maintenance agreement should become effective until both are executed. This is easiest to arrange when the same vendor is involved in both agreements. Second, the maintenance agreement should be correlated with the warranty provisions of the system to avoid paying for the same service twice. When the maintenance contract calls for providing the same service as the warranty, the service contract should not become effective until the warranty period expires. Finally, if the service contract provides more services than the system warranty, the wholesaler may want to have the contract effective immediately. However, he should negotiate for lower charges during this warranty period.

The above information is only a brief overview of maintenance contracts. It is recommended that wholesalers pursue this area extensively before making a contract decision. Maintenance and support costs over the useful life of a computer system can be quite high. Therefore, the agreements, to assure access to effective, efficient, and timely service, deserve the same extensive attention as do the choice and acquisition of the computer system.

Cost/Benefit Analysis[17]

This section reviews the major costs and benefits of the two computer system alternatives. Costs of continuing the present manual system have not been included because of the difficulty of quantifying overlapping functions in the present operations. Although the present manual costs are not developed, the benefits of the proposed alternatives reflect potential savings over the present manual system. Costs were developed which reflected the hardware configurations and software programs discussed in the previous section.

The description of each computer alternative includes ownership and operating costs over the system's life cycle.

Owership costs include *capital investment* and *other* costs Specifically, capital investment costs are facility modification, hardware, and software. Other costs are those for a consultant (if desired) and those for conversion and implementation. The ownership costs are shown in detail in appendix tables 3 and 4.

Operating costs include those costs of operating and maintaining the alternative over the system's life. These are additional personnel salaries, hardware and software maintenance, and computer supplies.

There are three major benefits of computer implementation discussed here: (1) Consistent or reduced personnel requirements as business volume expands, (2) increased financial control, and (3) increased inventory control. There should also be very substantial benefits which will accrue as a result of the decision support capabilities of these systems, but they are difficult to quantify and are not discussed here. The benefits addressed here have been shown primarily as an indicator of potential savings. They are not intended to reflect what an individual wholesaler could actually expect to save. The shown benefits of improved financial control and inventory control entirely reflect estimates received from successfully computerized wholesalers who based their figures on their own experience. An attempt has been made to keep the savings estimates as conservative as is reasonable.

The life cycle of each system was assumed to be 5 years (with no salvage value) and was amortized over the 5-year period at 15 percent interest. A 5-percent inflation rate has also been assumed.

Office personnel costs have not been included in the analysis on the assumption that data entry personnel will be drawn from the existing pool of office personnel and is not an added cost. However, for the mini data base system,

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[17] For those wholesalers considering the in-house development of a customized software package, see appendix.

Table 1.—Cost/benefit analysis, super microcomputer system[1]

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Five year total
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Costs						
Ownership[2]:						
Capital investment[3]	9,335	9,335	9,335	9,335	9,335	46,675
Other[4]	8,000					8,000
Operating[5]:						
Personnel[6]	0	0	0	0	0	0
System support[7]	3,240	3,402	3,572	3,751	3,938	17,903
Supplies[8]	1,200	1,260	1,323	1,389	1,459	6.631
Total costs	21,775	13,997	14,230	14,475	14,732	79,209
Benefits:						
Personnel[5]	0	0	15,000	15,750	16,537	47,287
Financial control[9]	72,500	79,750	87,700	96,450	106,050	442,450
Inventory control[9]	72,500	79,750	87,700	96,450	106,050	442,450
Total benefits	145,000	159,500	190,400	208,650	228,637	932,187
Net benefits	123,225	145,503	176,170	194,175	213,905	852,978

[1] Income and sales tax considerations are not included in this analysis because of the variability of income tax structures among wholesalers and sales taxes among states.

[2] See appendix table 3 for a detailed analysis and explanation of these costs.

[3] Initial cost of $32,700, amortized over a five-year period at 15 percent interest rate, using standard amortization table. This cost will vary with available interest rates.

[4] Includes consultant fee, conversion and implementation.

[5] Assuming 5 percent annual inflation.

[6] Data entry personnel will be drawn from the existing pool of office personnel.This is not an added systems cost.

[7] Hardware and software maintenance is based on 10 percent of $32,400, the purchase cost of hardware and software. Includes a service contract to have all hardware and software failures fixed without additional charge.

[8] Includes paper and tapes.

[9] Assumes 10 percent annual sales growth.

one part-time computer operator will need to be hired, at least initially, and that cost is reflected for the system.

All costs were effective as of October, 1985, and were based on estimates by computer companies, software vendors, computer consultants, and wholesalers presently computerized.

It was assumed that an independent consultant would be engaged to review requirements; evaluate potential software packages, their respective vendors, and the hardware for which the software is developed; negotiate a purchase; and generally oversee the implementation process. Someone with a broad knowledge of the industry, a practical understanding of the business operations, and a good understanding of computer system alternatives would be in a position to recommend the correct system. However, there is a proliferation of consultants, many of whom are poorly qualified. No official board regulates or certifies computer consultants, and there is no standard code of skills and procedures. Nevertheless, a good consultant can save the technically unsophisticated wholesaler from 10 percent to 25 percent of a system's cost by selecting an appropriate system and negotiating a good purchase. In accordance with an earlier recommendation for choosing reputable software vendors, a careful background check on the potential consultant is strongly suggested.

Tables 1 and 2 reflect the cost/benefit analysis of the super microcomputer and the mini data base computer systems. They include the ownership and operating costs for the 5-year life cycle of the system, the benefits (savings) that could accrue over the same period, and the net benefits that could be realized. The time frames of the analysis begin at the completion of the systems' implementation.

Super Microcomputer System (table 1)

An increase of 10 percent in annual sales volume has been assumed for wholesalers incorporating this system. Therefore, at a sales volume of $14.5 million[18] in year one, and increasing at 10 percent per year, the annual sales

Table 2.—Cost/benefit analysis, mini data base system[1]

Item	Year					Five year total
	1	2	3	4	5	
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Costs						
Ownership[2]:						
Capital investment[3]	20,869	20,869	20,869	20,869	20,869	104,345
Other[4]	14,000					14,000
Operating[5]						
Personnel[6]	12,500	13,125	13,780	14,470	15,194	69,069
System support[7]	6,810	7,151	7,508	7,883	8,277	37,629
Supplies[8]	2,000	2,100	2,105	2,315	2,431	10,951
Total costs	56,179	43,245	44,262	45,537	46,771	235,994
Benefits:						
Personnel[5]	0	15,000	15,750	33,075	34,730	98,555
Financial control[9]	100,000	115,000	132,250	152,100	175,000	674,350
Inventory control[9]	100,000	115,000	132,000	152,000	175,000	674,350
Total benefits	200,000	245,000	280,250	337,275	384,730	1,447,255
Net benefits	143,821	201,755	235,988	291,738	337,959	1,211 261

[1] Income and sales tax considerations are not included in this analysis because of the variability of income tax structures among wholesalers and sales taxes among states.

[2] See appendix table 4 for a detailed analysis and explanation of these costs.

[3] Initial cost of $73,100, amortized over a five year period at 15 percent interest rate, using a standard amorization table. This cost will vary with available interest rates.

[4] Includes consultant fee, conversion and implementation.

[5] Assumes 5 percent annual inflation.

[6] One part-time computer operator. Other data entry personnel will be drawn from the existing pool of office personnel and is not an added systems cost.

[7] Hardware and software maintenance based on 10 percent of $68,100, the purchase cost of hardware and software. Includes a service contract to have all hardware and software failures fixed without additional charge.

[8] Includes paper and tapes.

[9] Assumes 15 percent annual sales growth.

volume in years one through five will amount to $14.5 million, $15.95 million, $17.54 million, $19.29 million, and $21.21 million respectively.

The benefits of this system are as follows:

Personnel - with a 10-percent annual sales expansion, the wholesaler can avoid hiring at least one additional office worker in year three. At a 5-percent inflation rate, over $47,000 can be saved by the end of the 5-year life cycle of the system.

Financial control - Substantial savings will be realized by eliminating clerical errors in adding and extending sales slips, improving control over accounts receivable, and better tracking of individual saleman's performances. Estimates by successfully computerized wholesalers of savings in this area ranged from 1 to 2 percent of annual sales. A conservative one-half percent of sales has been used in this analysis and amounts to over $442,000 in savings over the 5-year cycle.

Inventory control - Savings from decreased waste, theft, shrinkage, and deteriorization by increased control of inventory was also estimated by successfully computerized wholesalers to range from 1 to 2 percent of sales per year. Again, a conservative estimate of one-half percent of annual sales has been used here, and amounts to over $442,000 in savings over the 5-year cycle.

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[18] This was the average sales volume of the wholesalers interviewed for this study. See "Present Systems Analysis" section of this report for additional information on the typical wholesaler studied.

Using conservative savings estimates, the super microcomputer system could pay for itself within 1 year of a *successful* implementation and have a net benefit of approximately $853,000 at the end of the 5-year life cycle.

Mini Data Base Computer System (table 2)
An annual sales volume increase of 15 percent has been assumed for larger wholesalers incorporating this system. Therefore, with an assumed sales volume of $20 million[19] in year one, annual sales volume for years one through five amount to $20.0 million, $23.0 million, $26.45 million, $30.42 million, and $35 million respectively.

The benefits of this system are as follows:

Personnel - With a 15 percent annual sales expansion, the wholesaler can avoid hiring one additional office worker in year two, and avoid hiring a second worker in year four. At a 5-percent inflation rate, more than $98,000 can be saved over the 5-year life cycle.

Financial control and inventory control - With this system integrated into virtually every area of the wholesaler's business, the potential for savings in all areas is at least as great as the potentials for the smaller super micro system. Again, using conservative estimates of one-half percent savings of annual sales, each of these two areas will realize almost $675,000 in savings over the 5-year cycle.

As with the super microcomputer system, using conservative savings estimates based on experiences of *successfully* computerized wholesalers, the mini data base computer system will pay for itself within 1 year of a *successful* implementation, and have a net benefit of approximately $1.21 million at the end of the 5-year life cycle.

Conclusion and Recommendations

Decreased system costs, technological advancements, and an emerging availability of application software make the purchase of a computer system feasible for most fruit and vegetable wholesalers. Increased efficiency of paperwork processing and decision support should result in benefits not only from fewer personnel requirements and increased financial and inventory control, but also from greater opportunities for management to be far more informed and competitive. Wholesalers who have successfully implemented computer systems have reported sales volume and cost reduction rates in excess of those cited in the previous analysis. They have improved efficiencies through more sophisticated buying practices, better pricing strategies, increased financial and inventory controls, and superior service to their customers.

Discussion of the two computer system alternatives in this report should not be construed as representing the only feasible alternatives in the market place. However, they could be considered the "state of the art" as of this writing.

The super microcomputer system is recommended for the majority of wholesalers who have determined their need for a system, have gross sales under $15 to $20 million annually, desire a relatively simple system with the least possible disruption of their internal operational procedures, and don't expect sales volume to increase above $30-$35 million in the next 4 or 5 years. The system could pay for itself within the first year after implementation and produce a 5-year life cycle savings of over $850,000.

The mini data base computer system is recommended for upper-end mid-level wholesalers (over $20 million in annual sales) who expect substantial growth over the next four or five years, and for wholesalers whose sales presently exceed $30 to $35 million. It is important to be aware, however, that the larger system is more sophisticated and will require major operational changes in all areas of the business. The implementation of this system should be executed over a substantially longer period of time than the super micro computer system, and previous experience with computers would increase considerably the speed of and odds for successful implementation. The system could pay for itself within the first year after implementation and produce a 5-year life-cycle savings of about $1.21 million.

Finally, there is no simple formula which guarantees a successful implementation. A combination of variables must mesh together well for an optimum solution. Many of these variables have been discussed in this report: (1) A clear understanding of the wholesale companies' requirements; (2) a concern for the welfare of the company's employees (3) total support from top company management; (4) a quality computer system (software, hardware, and people); (5) a competent, informed, and reliable vendor from whom the hardware and software were purchased; (6) a well planned and timely system implementation; (7) good user documentation that provides clear instructions for operating the system; (8) adequate training for the users of the system; and (9) adequate and reliable single-source support (service contract) to assure the continuity of the system with a minimum of disruption and downtime when repairs are necessary.

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[19] As stated earlier in the report, this system is intended to satisfy the needs of most large wholesalers with over $30 million in annual sales, or those upper-end mid-sized wholesalers ($20 million in annual sales) who expect substantial growth in the next few years. Previous computer experience is highly recommended, if not required, to avoid organizational pitfalls.

A good computer system can be compared to a living organism—always evolving. It should have the flexibility of changing, growing; and adapting with the varying requirements that occur regularly inside and outside of a modern-day wholesale fresh fruit and vegetable company.

The Development of a Customized In-house System

The alternative that many, if not most, wholesalers have chosen is the development of a customized system for their own use. This has often been necessary because of the lack of adequate software in the marketplace.

To develop these systems, wholesalers hire technical consultants, many of whom are not familiar with the industry, to evaluate their requirements and recommend a computer solution. Then they commit financial and personnel resources to the project. The results to date have been mixed.

Those companies which have been large enough to sustain the cost of the entire project over a long period of time have eventually developed suitable systems. Others have been left with a partial system or, in some instances, a computer which handles nothing but receivables and payables.

When considering in-house development, wholesalers should be aware that the cost of the computer system may escalate well beyond original estimates, and the result may be below expectations.

A typical development project for the industry which would include 80 percent of the requirements discussed in the analysis would cost approximately $40,000 in software alone, plus the additional costs discussed earlier. And there is no guarantee of success.

The risk factor in new development is quite high. Therefore, it is recommended that whenever possible, wholesalers purchase software which has already been developed and tested in the marketplace.

Ownership Cost Tables

Table 3.—Ownership costs of super microcomputer system[1]

Item	Dollars		
Capital investment:			
Facility modification - dedicated power line[2] and voltage fluctuation control[3]		300	
Hardware:			
Computer[4]	16,000		
High speed printer (300 lines per minute)	4,500		
Keyboard terminals and screen (3 each)	3,600		
Cables, interfaces, etc. installed	300		
Total hardware		24,500	
Software:[5]			
Accounts/receivable	800		
Accounts/payable	800		
General ledger	800		
Data base	500		
Fruit and vegetable application package[6]	5,000		
Total software		7,900	
Total capital investment			32,700
Other:			
Consultant[7]	4,000		
Conversion and implementation by vendor:			
Installation support[8]	0		
Modification of software to wholesaler's individual requirements[9]	4,000		
Training[10]	0		
System load[11]	0		
Total other			8,000
Total ownership costs			40,700

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[1] All costs effective as of October 1985 based on manufacturer list prices.

[2] A separate electrical circuit to be used only for the computer system.

[3] A device that safeguards the operation of the computer by preventing temporary fluctuations in the company's electrical power.

[4] These items can be purchased as a package (bundled) from the manufacturer: Central processing unit with 512Kb internal memory, one 40 megabyte disk drive, 1 cartridge tape drive, 4 ports, one multi-user operating system, and one modem.

[5] Includes all user documentation. See "Alternative Systems Analysis" section for more detail.

[6] As described earlier. See figure 14 for inputs and outputs.

[7] Eight days at $500 per day. This service is not required but is recommended.

[8] Includes test of equipment, installation of software, initial orientation, and reasonable modification of software to wholesaler specifications.

[9] Includes an additional 10 days of systems customization (programming) at $400 per day.

[10] Includes a minimum of 6 days onsite training plus phone service for first 90 days. Additional training at a cost may be required.

[11] Supervise loading of all files. This is separate from training time.

Table 4.—Ownership costs of mini-data base computer system[1]

Item	Dollars		
Capital investment:			
Facility modification[2]		5,000	
Hardware:			
Computer[3]	23,000		
55 megabyte disk drive	7,500		
High-speed printer (300 lines per minute)[4]	6,200		
Low-speed printer (200 characters per second)	2,500		
Keyboard terminals and screens (4 each)	5,200		
Terminal cables and installation	1,200[5]		
Total hardware		45,600	
Software:[6,7]			
Accounts receivable			
Accounts payable			
General ledger			
Fruit and vegetable package[8]	22,500[9]		
Total software		22,500	
Total capital investment			73,100
Other:			
Consultant[10]	6,000		
Conversion and implementation by vendor:			
Installation support[11]	0		
Modification of software[12]	8,000		
Training[13]	0		
System load[14]	0		
Total other			14,000
Total ownership costs			87,100

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[1] All costs effective as of October 1985 based on manufacturer list prices.

[2] Includes a 75 square foot room constructed for computer and peripherals. Consists of antistatic raised flooring, air-conditioning, ducting, dedicated electrical circuit, glass enclosure, and security locks.

[3] These items can be purchased as a package (bundled) from the manufacturer: Central processing unit with one megabyte internal memory, one 55-megabyte disk drive, one tape drive, one system console terminal, seven terminal ports including one for modem and/or diagnostics, system peripheral interface, operating system, data base system, data inquiry system, built-in voltage fluctuation control, and one modem.

[4] Includes computer interface.

[5] This cost will vary according to the distance between the terminals and the CPU. The present cost is based on three 200 foot cables.

[6] Includes all user documentation. See "Alternative Systems Analysis" section for more detail.

[7] Most vendors in the marketplace have already developed and integrated the accounts receivable, accounts payable, and general ledger programs into the minicomputer fruit and vegetable application. Therefore, the fruit and vegetable package price reflects these programs.

[8] As described earlier. See figure 14 for inputs and outputs.

[9] These packages are "value-priced" by the vendors. Therefore, the package will vary in price depending on the size of the computer hardware. With a mini-computer, a typical rule-of-thumb is that software costs will be approximately 50 percent of hardware costs.

[10] Includes 10 days at $500 per day. This service is not necessary but is highly recommended.

[11] Includes test of equipment, installation of software, initial orientation, cosmetic enhancements, and reasonable modification of software to wholesaler's specifications.

[12] Includes an additional 20 days of systems customization (programming) at $400 per day.

[13] Includes a minimum of 20 days of onsite training plus phone service for first 90 days. Additional training may be necessary.

[14] Supervise loading of all files. This is separate from training time.

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